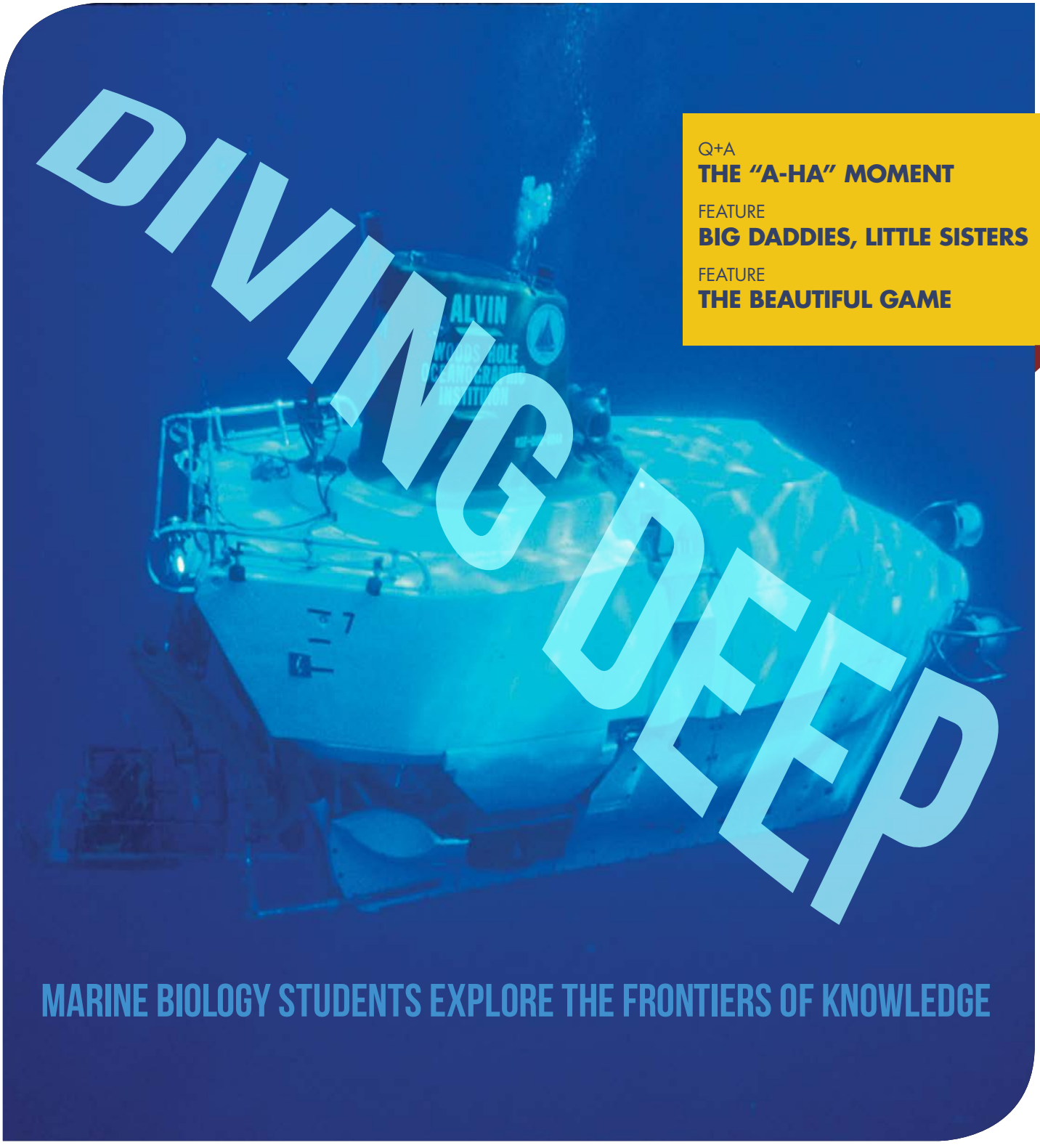
UNDERGRADUATE RESEARCH EDITION

CASCADE

FALL 2014

UNIVERSITY OF OREGON COLLEGE OF ARTS + SCIENCES



DIVING DEEP

MARINE BIOLOGY STUDENTS EXPLORE THE FRONTIERS OF KNOWLEDGE

GUEST EDITORIAL

This entire issue of *Cascade* is dedicated, cover-to-cover, to undergraduate research. This page is usually reserved for a message from the dean, but we are turning it over to Carly Wright, a junior in physics, for her first-person story. In this photo, she shows her stuff at last May's Undergraduate Symposium (see page 26). Her research involves manipulating light with this forked diffraction grating, composed of two glass slides glued together with film in the middle.

If I've learned one thing about research, it's this: The process of discovery is full of challenges.

I came to the University of Oregon for architecture—and because the UO had numerous options if architecture didn't work out. It didn't, and that's when my own discovery process began.

On my dad's advice, I did an internship at a petroleum engineering firm after freshman year. I got some valuable advice from a company executive: There are good jobs in the hard sciences. I've always loved physics and math, and I was up for the challenge.

I found my passion for learning in physics. It's fascinating to think of the world around us in terms of physics—many aspects of the world can be simplified into a model described by physics. I like working with my hands, so I started spending time in the Advanced Projects Lab, shooting lasers through mirrors and building vacuum systems.

Still, I was missing a major aspect of the physics experience. So I began another round of self-discovery: I talked to professors about the options available in research. After attending meetings of the Society of Physics Students, I found a home in applied physics—professor Miriam Deutsch accepted me into her lab.

This was my first exposure to a research group. Listening to her graduate students explain their projects, I saw why research is important, how it can be applied to improving lives.

BY CARLY WRIGHT

MATT COOPER

FYI: ACCORDING TO HER PHYSICS MENTOR BEN MCMORRAN, CARLY IS NOT ONLY A WHIZ AT NANOFABRICATION, BUT ALSO MAKES A MEAN CHEESECAKE AND IS A ROLLER DERBY PLAYER WHO IS "BERSERK" ON THE TRACK. HIS ENTIRE LAB TURNS OUT TO CHEER HER ON.

That led to another lab and my first research project: Ben McMorran, an assistant professor, put me to work using a scanning electron microscope for nanofabrication. Now I'm working on creative ways to overcome technical hurdles in this field. Ben has given me many opportunities to discover what my career might look like, by pointing me to conferences and helping me present and publish my findings.

Research makes me really passionate about what I do, and it's improved my life in ways that aren't quantifiable: I'm more productive now, I can keep to a schedule, my social skills have improved quite a bit—I enjoy talking to people about what I do.

It hasn't always been easy—research can be incredibly frustrating. It's full of challenges, but those challenges are beneficial; they have helped me enjoy what I'm doing even more and have inspired my creativity.

Learn to love the challenges. It will help you enjoy the process of discovery—in the lab, and within yourself.

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The "A-Ha" Moment

THE TURNING POINT IN THE JOURNEY OF DISCOVERY

This is the second edition of *Cascade* magazine devoted entirely to the subject of undergraduate research and scholarship. Our first edition, published in winter 2013, was such a popular success that we have decided to make this an annual celebration of the original, inspiring work pursued by undergraduates in the College of Arts and Sciences.

This magazine is a window into a pervasive effort on campus to involve more students—and involve them more visibly—in research endeavors. This can range from oceangoing marine biology expeditions (page 8) to diving deep into the stacks in the library and online resources to ask—and explore—a personally meaningful intellectual question (many examples to follow).

Along with *Cascade*, another highly visible vehicle for showcasing student work is the UO's annual Undergraduate Symposium (see page 26). Now in its fourth year, the most recent symposium last May was a daylong event featuring more than 100 UO undergraduates—in fields ranging from anthropology to architecture to Russian studies—who shared their work publicly, in much the same way that professional scholars do: via posters and presentations.

We asked Lisa Freinkel (above, right), vice provost for undergraduate studies, to help us define our terms and tell us more about what's special about the undergraduate research experience here at the UO.

INTERVIEW BY LISA RALEIGH

Q: First of all, what do we mean by research?

LF: Research can evoke images of Bunsen burners, petri dishes and folks in white coats; it's a word that tends only to mean scientific investigation. But our students investigate and innovate in as many different ways as there are academic and professional disciplines. So when we talk about the Undergraduate Symposium, we avoid the word "research" in its title. Instead we have a tagline that tries to capture the full range of student discovery: "celebrating undergraduate achievements in research, scholarship, creativity and innovation."

Besides work in science laboratories, our students are embarking on projects in the performing arts, they're embarking on projects that are getting them dusty in the archives and they're embarking on entrepreneurial endeavors in the business school. What links all of this together is that very deep "a-ha" moment when a student goes from assimilating information that's been transmitted to them by their instructors to

INTERESTED IN RESEARCH?

If you're an undergraduate interested in pursuing a research project—in the lab, in the library or in the field—contact ugresearch@uoregon.edu to get connected with faculty mentors.

suddenly shaping something that feels new: that moment where their own personal sets of beliefs, questions and interests start to gel with the information and the methods they've been schooled in, allowing something new to emerge.

That "a-ha" moment is really the crowning moment for the educator. Of course it's wonderful when a student really gets what you're trying to say—but what's really spectacular is when they return the serve to you and the volley begins.

Q: So how does a student get from the "a-ha" moment, where you see that turn take place, to developing a project that results in presenting at the symposium? Talk about what happens from that point forward.

LF: A student begins with a sense of what she wants to say or do—with something she wants to bring to the world. The work of getting from that moment to a presentation is a work of midwifery from the standpoint of the faculty: You're helping "deliver" a brand-new idea. From the student's perspective, it's about mastering the skills needed to take what may be an inchoate idea and give it shape. It's about even deeper immersion in the discipline and about acquiring the materials—which may be raw materials, data, archival materials—that will allow the project to emerge. Then, between the honing of skills and pulling materials together, a special process of iteration takes place where the student shapes something, shares it with her faculty mentor, gets feedback, then reshapes it. Through that process of iteration, you go from that initial "a-ha" to the research paper or poster or work of art, or whatever the end product may be.

And then that's not even the end, because then the student's work is out in the world and it joins the conversation among other scholars, researchers and activists, which leads to more feedback—and the conversation continues. That's the moment where the university's impact, and the impact of undergraduate education, is felt within the broader region, state, nation, world. That's the payoff moment for society. But for the student, the whole process is the payoff.

Q: How about the middle of this process, when you create a hypothesis and then test it ?

LF: First of all, let's dispel the image of the lonely researcher or artist up in their garret creating something—I don't think that's really how human creativity flourishes. It's all about conversation and, just like in a conversation, you may begin by knowing exactly what you want to say, but then somebody responds and your viewpoint suddenly, necessarily, shifts. That process of elaborating an idea yields insights along the way.

And some of those insights may be painful, like, "Oh, I was completely wrong. My initial hypothesis is flawed and this research isn't yielding clear results." That's an "a-ha," too. "A-ha" is not always a happy, smiley-face moment. It can be the moment where it's back to the drawing board. But at the same time, it's all moving forward. And what's exciting is that it's forward movement for the individual student, the faculty member, and in the end, for the whole community—because what you're seeing is the development of human culture, of human potential. This is how we get from the first discovery of fire to the Internet.

Q: Lots of universities create opportunities for undergraduates to have experiences like those you have been describing. What's different here?

LF: The four facets of human discovery—research, scholarship, creativity and innovation—come together at the University of Oregon in a unique way that's really a feature of the university's size, a feature of the strength of the College of Arts and Sciences and a feature of the very specific shape that our professional schools and the collaborations across schools and colleges have achieved.

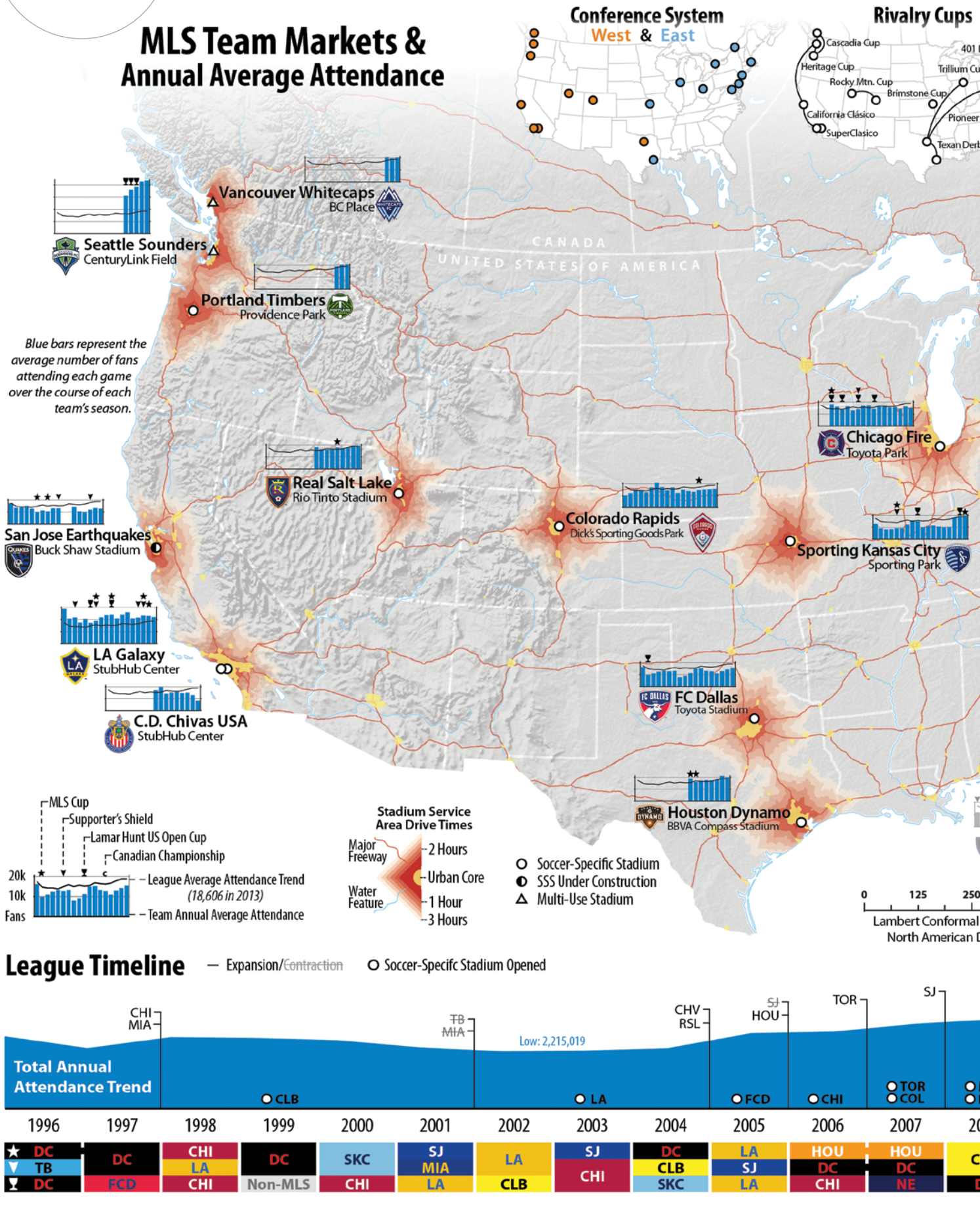
These collaborations reflect the flavor of this place, this campus. Even though we are a public research university, I think we feel much smaller than we actually are. Our beautiful campus feels unifying and whole; part of the experience of physically being here is that you feel like you've joined a true community. You've landed in a place that is human-sized and physically integrative.

Another factor: At the UO, our students are passionately engaged in thinking about the world around them. They have that spark to want to make the world a better place, to resolve social injustice and inequity—but they're also wanting to do data-driven research, which will help them be activists with an edge. They're merging social consciousness with academic rigor and personal passion, and that's a winning combination.

Q: Sounds like there's something unique about UO students, too.

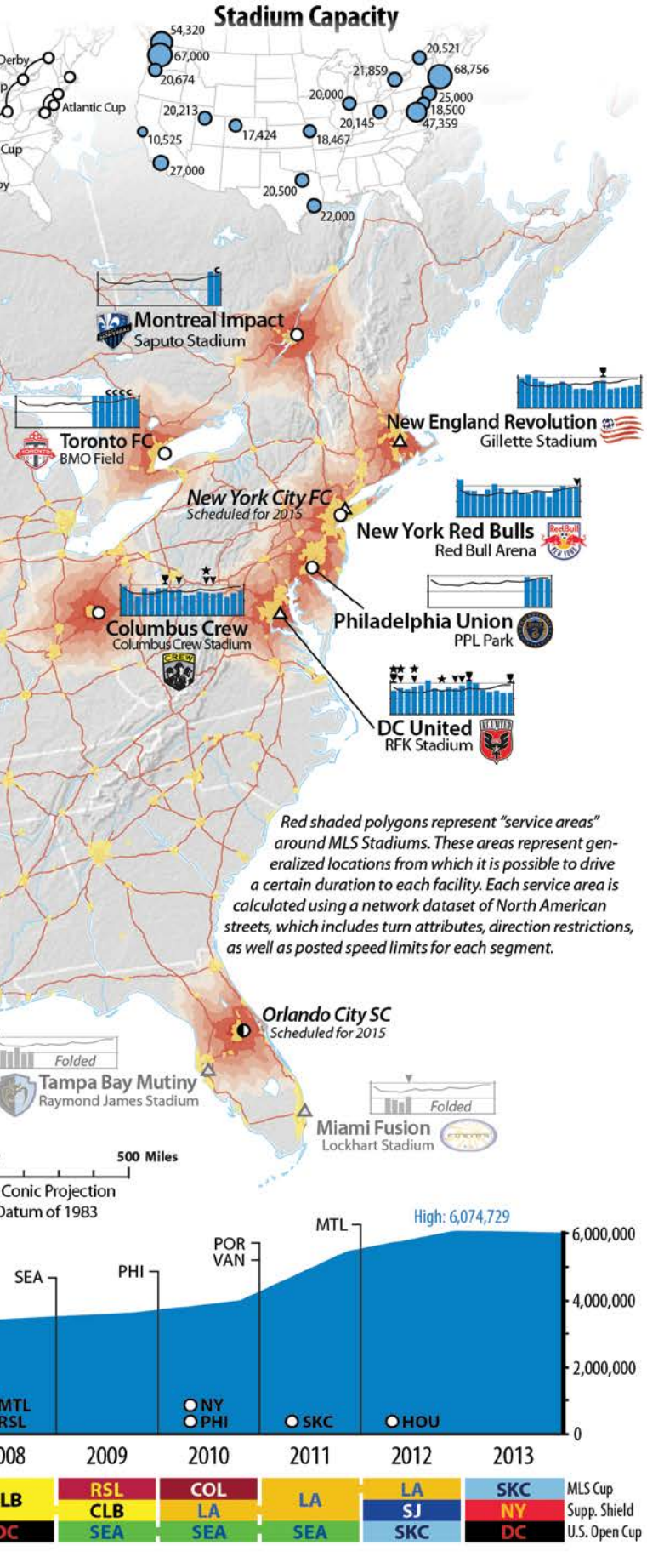
LF: Our students come to the world with a genuine curiosity that's born from a certain humility, a certain sense of wonder. So they sometimes ask questions that nobody in their right mind would ask. I think our students are humble enough to ask really big questions, which sounds like a paradox, but often when you're coming from a position of being already invested in your own sense of self-worth, it's hard to take risks: There's more to lose.

I do also want to say a word in favor of the quirky. We're two hours south of Portland, but this isn't the land of *Portlandia*, and that's all to the good. I think we're quite grounded here and down to earth. But the flavor of the Pacific Northwest that runs through both Eugene and Portland is a willingness to not always look so clean and tidy. To not always have it figured out—just taking your intuition and seeing where it leads. Iteration and discovery: Try something, see what comes back, and take it from there. "A-ha" may not always look like a straight line leading to an obvious destination—but I guarantee that the journey will be well worth it.



League Timeline

— Expansion/~~Contraction~~ ○ Soccer-Specifc Stadium Opened



THE BEAUTIFUL GAME

Soccer map wins *National Geographic* award

Riley Champine had no trouble at all coming up with a subject for his project in an upper-level mapping class: soccer.

The course was Advanced Cartography. Instructor James Meacham assigned students to develop an idea for a map that would incorporate all the techniques they were to learn over the 10-week term, including design, data sourcing and how to present geographic information visually. Above all else, Meacham said, the map should tell a story.

Champine, a former player and current referee of "the beautiful game," created a map covering the history of professional soccer in the United States, complete with each team's attendance, reach and stadium details. It's an understatement to say he scored. "A Cartographic Visualization of Major League Soccer in 2014" (left) won first place this year in the National Geographic Award in Mapping competition, earning Champine $900 and a world atlas.

Cont'd on next page

The North American Soccer Experiment

The United States hosted the Fédération Internationale de Football Association (FIFA) World Cup in 1994 on the condition that it would create a new professional soccer league and foster "the beautiful game" nationwide. In April 1996, 10 teams spread across the country began competition and fulfilled the promise.

Since its inaugural season, major league soccer has experienced tremendous financial hardship—at times so dire that three teams folded or moved. Moreover, soccer still ranks as only the fourth or fifth most popular sport in the US and receives little coverage on mainstream networks. Yet despite these challenges, the league has grown. Twelve "soccer-specific stadiums" (SSS) have been built and two more are currently under construction.

Ten teams have successfully entered the league, including three from Canadian cities. Two more are scheduled to join their ranks in 2015. The map at left illustrates the growth of soccer in a geographic and temporal context that describes the location, fans, stadiums and titles won by each team. This is the spatial story of the extraordinary new, unique and constantly evolving experiment in professional sports called major league soccer.

—Riley Champine

cont'd from previous page

Although he came to the UO to study journalism, everything changed for Champine (right) when he took a geography class for a general-education requirement; it included a weekly two-hour lab, which enabled Champine to immediately put into practice all that he was learning from lectures. "We were producing maps right off the bat, and that really surprised me," he said. "That's what's cool about the lab setup—you learn the software and technology through your own trial and error."

Champine was quickly hooked on the same idea that Meacham would later emphasize in the upper-level course: Maps should tell stories, bringing together reams of data from various sources, gleaning the crucial information and presenting it in a way that is clear and compelling, even aesthetically pleasing.

"Looking at a database or an Excel spreadsheet is probably the furthest thing you can think of from storytelling—it's raw, it's boring," Champine said. "But maps are about telling and showing. When you make a map, you make that raw information much more intriguing."

Now a senior majoring in geography and planning, Champine set about his soccer map with the passion of a true fan of the game. Key to his success was the geography department's InfoGraphics Lab.

Under Meacham's guidance as executive director, the lab completes projects for faculty members, campus offices and government agencies. Those projects range from the routine—say, up-to-date maps of campus—to the exquisite. The lab in 2012 created the *Atlas of Yellowstone*, the first-ever of a U.S. national park and a state-of-the-art reference volume that has received national acclaim.

The lab—which offers students paid positions and work space for projects—provides training in geospatial technologies, a heady term for today's advanced mapping used in business, education and government.

Geospatial technologies are a booming field in geography. The combination of mobile devices, the Internet and global positioning systems—read: satellites—is enabling anyone, anywhere, to send and receive unprecedented amounts of data about physical locations. It's using your smartphone, for example, to read restaurant reviews simply by holding the phone up at a street corner and scanning the neighboring eateries; it's also the real-time mapping of victim locations, services and open roads during a disaster.

This geospatial revolution is changing how mapping and other forms of geographic research are done; it's also creating a wave of new jobs and products.

Most universities serve students' interests in one of those areas—research, job training or technology development—but the UO caters to all three, said Ken Kato, associate director of the lab.

"Students know they want to work with mobile technology and geospatial data—what blows their minds is what can be done with it," Kato said. "We blur the lines between research, education and technology so students find what's right for them."

Champine's soccer map is a perfect example: What started out as a classroom assignment became a research project—his map draws from existing data to create new knowledge about the history of the league, Meacham said.

As the project deadline approached, Champine found himself working nearly nonstop on the map, even tinkering with details while listening to lectures in other classes. He and Meacham met weekly; the two went back and forth over how much information to include, with Champine's hunger for statistics eventually yielding to Meacham's push for an end product that is clean and inviting.

Champine also put drafts of the map in front of his classmates, collecting not just favorable reviews but plenty of insightful criticism. That's a real strength of the geography department, he said—the culture is "positive and collaborative," with faculty members and students pulling together, lifting not just a particular individual but everyone in the department.

That's no accident. The department practices "collaborative learning," Meacham said, because cartographers don't work in a vacuum; students must get comfortable with the consensus-building they'll do as professional mapmakers, working with statisticians, planners, engineers, managers, historians and even the general public.

"Mapping projects always involve teams of experts from different areas," Meacham said. "Very seldom do you get a cartographer just doing their own thing." —Matt Cooper

TIM CHRISTIE

Where the Jobs Are

Many students majoring in geography at the UO have gone on to infographics-related careers. Here's a sampling of recent alumni who majored in geography (or majored in geography and another field, as indicated):

- **Sage Limpp-Wagner** '13 (major in geography and German), visual data specialist, contracting for Google Maps
- **Brad Simantel** '12, software engineer, Elemental Technologies
- **Michael Wilburn** '11, ocean basemap cartographer, Environmental Systems Research Institute (ESRI)
- **Steve Bassett** '10, cartographer, The Nature Conservancy
- **Jesse Nett** '10, cartographer, USDA Forest Service
- **Patrick Hammons** '09, specialist, geographic information systems, City of Philadelphia
- **Nicholas Martinelli** '06, software developer and cartographer, TerraSeer
- **Craig Greene** '02, cartographer and product owner, ESRI
- **Erik Strandhagen** '02, senior scientist, Integral Consulting
- **Erin Aigner** '99 (major in geography and environmental studies), former graphics editor, *The New York Times*; current content strategist, Second Story

BIG DADDIES, LITTLE SISTERS

Combining passion for gaming with love of literature

The video game *BioShock* has all the trappings of today's elaborate first-person shooter games: monstrous adversaries, breathtaking cityscapes and ample amounts of graphic violence.

But can a blood-and-guts video game be used to explore what it means to be a man—or a woman?

Jason Irrgang (below) was determined to find out, parlaying his personal history as a gamer into a rewarding academic pursuit.

There was a time when the idea of taking on a massive research project would have been fantasy. Irrgang, who graduated from the UO over the summer, was a self-described "terrible student" in high school, battling drug addiction; however, he found his footing in community college and after transferring to the UO, quickly pushed his GPA over 3.70 and won admission to the English honors program. To receive his degree with honors, Irrgang was required to write a fifty-page critical essay based on his own research and interpretation.

It was a challenge he wholeheartedly embraced—combining his passion for gaming and his love of literature to demonstrate that video games are no less appropriate than Shakespeare or *Beowulf* as vehicles for literary criticism. In fact, his research subject—the post-apocalyptic game *BioShock*—incorporates ideas from popular authors Ayn Rand and George Orwell.

MATT COOPER

To explore the issue of gender, Irrgang focused on the game's central characters: "Big Daddies," the hulking, half-man, half-machine antagonists that exist only to kill or work as laborers; and "Little Sisters," diminutive female innocents with reproductive qualities essential to the survival of the underwater city of Rapture. In his paper, Irrgang concludes that the game is an excellent example of the controversial belief that sexual physiology—rather than culture—dictates male or female behavior.

Students in the English honors program can take two terms that are devoted completely to their thesis, thereby easing the regular academic load while concentrating on their research and receiving guidance from an adviser. That guidance was critical for Irrgang, who relied on associate professor of English Betsy Wheeler to help him fine-tune his project and soldier on during those periods when he felt overwhelmed.

"This is all on you—this is your idea and the university isn't going to hold your hand," he said. "I often was really anxious about this project and whether I could actually get this done. I needed someone who could talk me through it."

His mentor, Wheeler, is an admirer. "His project shows the possibilities for undergraduates to do research that is innovative, theoretically sophisticated and very important—politically and socially," she said. And the content of his project is important from a scholarly standpoint because "he is criticizing the construction of masculinity in gaming from the standpoint of a cultural insider—a man and a gamer."

Now an advocate for the transformative power of education, Irrgang seeks to inspire others: He volunteers as a tutor with an agency that provides services to children affected by abuse, neglect, drug addiction and homelessness. He recalled spending months helping a student pass a state assessment exam and pursue his own dream of going to college.

"When I started tutoring him, it was like I was looking at me ten years ago," Irrgang said. "It was very gratifying."

The next stop is Detroit: Irrgang has joined Teach for America, a national corps of recent college graduates who commit two years to teaching and effecting change in underprivileged urban and rural public schools. Irrgang's "thoughtful masculinity" will make him a great role model, Wheeler said. —MC

What Can You Do with an English Degree?

Here are examples of the career directions several recent English alums have taken:

- **Melissa McGlensey** '13, fellow, *The Huffington Post*
- **Brian Tompkins** '12, personal banker and loan officer, US Bank
- **Brianna Brey** '11, arts, culture and music editor, *Source Weekly*
- **Benjamin Unger** '11, elected state representative, Oregon
- **Alyssa Waldman-Roberts Dodds** '09, English teacher, Springfield High School
- **Zac Bond** '08, digital marketing analyst, Lunar Logic
- **Elizabeth Olsen** '08, vice president, marketing and communications, Ferguson Wellman Capital Management
- **Joshua Suman** '08, media coordinator and site coach, Jubilee REACH (Relationship, Education, Assistance, Community and Hospitality)

DIVIN

Top left: The giant Pacific octopus shown here and other marine animals enjoy the natural seawater that flows through the teaching and research labs at the Oregon Institute of Marine Biology. Other "giants" sometimes seen in the area around OIMB are northern elephant seals, giant sunflower stars, the world's largest chiton (an 8-shelled mollusk) and several species of whales, including the blue whale, the world's largest organism.

Top right: The famed submersible* Alvin*, shown here and on the cover, is a three-person vehicle that takes scientists—and even UO undergraduates—thousands of feet down into the ocean depths to observe creatures of the deep.

At low tide near Cape Arago on the southern Oregon coast, the ocean recedes and a living laboratory is revealed.

On kelp-covered rocks dotted with tide pools, students from the Oregon Institute of Marine Biology spend hours searching out, measuring and cataloging the myriad forms of sea life exposed in coves along the rocky shoreline. Often they learn about a particular organism in a lecture class in the morning, then spend the afternoon observing it in the tide pools.

But they might just as easily be onboard the *Pluteus* (left), a 42-foot research ship equipped with its own remotely operated submersible. Every student who takes the subtidal and deep-sea ecology course learns how to drive the minisub, which is equipped with video cameras and a robotic arm that let students study the huge diversity of sea life just off the Oregon coast.

At the institute's picturesque campus at the mouth of Coos Bay, a half-dozen research labs probe the frontiers of marine knowledge as part of the only marine biology degree program in Oregon. A substantial amount of the research expanding those frontiers, in labs both indoors and outdoors, is done by undergraduates.

"One of the coolest things about being here at OIMB is you don't just read about science, you get to do it," said Christy Stumbo, who wrapped up both her degree in marine biology and her part in a research project this summer. "You get your hands dirty and your feet wet."

G DEEP

AT A PICTURESQUE CAMPUS AT THE MOUTH OF COOS BAY, SCIENTISTS AND STUDENTS PROBE THE FRONTIERS OF MARINE KNOWLEDGE

BY GREG BOLT

Opportunities for undergraduate research are many. Students regularly take part in ongoing, long-term studies being conducted by members of the OIMB faculty, including one that helps estimate the annual Dungeness crab harvest on the entire Pacific Northwest coast. They often are recruited for other projects in the labs of individual professors. And undergraduates also are encouraged to take on their own research, whether for honors programs, to earn additional academic credit, prepare for graduate school or postgraduation employment or simply to satisfy their own curiosity about the marine world.

TALENTED HANDS, GOOD ENERGY

Craig Young, OIMB's director for the past 12 years, said bringing undergraduates into the institute's research projects isn't an afterthought—it's a vital tool that helps professors take on funded research that otherwise would be difficult to complete.

"Undergraduates are critical to some of our research programs," Young said. "When a faculty member gets a National Science Foundation grant that needs the help of a lot of talented hands, some good energy and some patience, it's often undergraduates that make the work possible."

Located in the fishing village of Charleston, OIMB sits on forested land wedged between the town's harbor and the mouth of Coos Bay. The scenic, 130-acre campus is mostly forest and headlands that haven't changed much since it was home to bands of Coos and Coquille Indians long before the arrival of Europeans.

The main buildings have a distinctly maritime look: gray-shingled siding with white trim around the windows, many with second-story dormers that look out onto the harbor. Students stay in dorms on the top floor of three of the larger buildings, while a row of cottages provide housing for the many visiting researchers drawn to the institute by both its reputation and location.

> "ONE OF THE COOLEST THINGS ABOUT BEING HERE AT OIMB IS YOU DON'T JUST READ ABOUT SCIENCE, YOU GET TO DO IT. YOU GET YOUR HANDS DIRTY AND YOUR FEET WET."

Fresh seawater pumped from the bay flows to all of the labs, which also house high-tech microscopes, machines for analyzing DNA and other instruments needed in marine research. The seawater bubbles through rows of laboratory tanks that can hold anything from microscopic plankton to a giant octopus.

All UO students seeking a degree in marine biology are required to spend three terms at OIMB, typically in their junior or senior

But What She Really Wants To Do Is Teach

Christy Stumbo relished her work with OIMB director Craig Young on a project investigating sea squirts. However, as rewarding as the research experience was, Stumbo realized that what she really wants to do is teach. She graduated last spring with a resume featuring research skills acquired at OIMB and also experience as a biology tutor and community educator with the Environmental Leadership Program. This triple combination landed her a job as a naturalist at an outdoor science school near Santa Cruz, Calif.

Read Christy Stumbo's story in Online Extras at **cascade.uoregon.edu**.

year. Although the terms don't have to be taken sequentially, usually they are. The academic year runs through spring, summer and fall, with faculty members typically reserving winter term for research.

"THEY CAN'T KEEP ME AWAY"

But even with no classes to take, a fair number of undergraduates stick around campus in winter, enlisted by professors to take part in research or to pursue projects on their own. At times it seems as if students cling to the institute with all the tenacity of the barnacles that cover the wave-splashed rocks of Cape Arago.

"They can't keep me away," said Anders Hansen, an undergraduate who's starting his second year at OIMB this fall.

While pursuing his degree, Hansen has been working with professor Alan Shanks on long-term research tracking the movement of certain species of plankton. Shanks studies the life cycle of marine invertebrates such as sea urchins, which depend on ocean currents to spread their larvae, known as plankton, to new habitat.

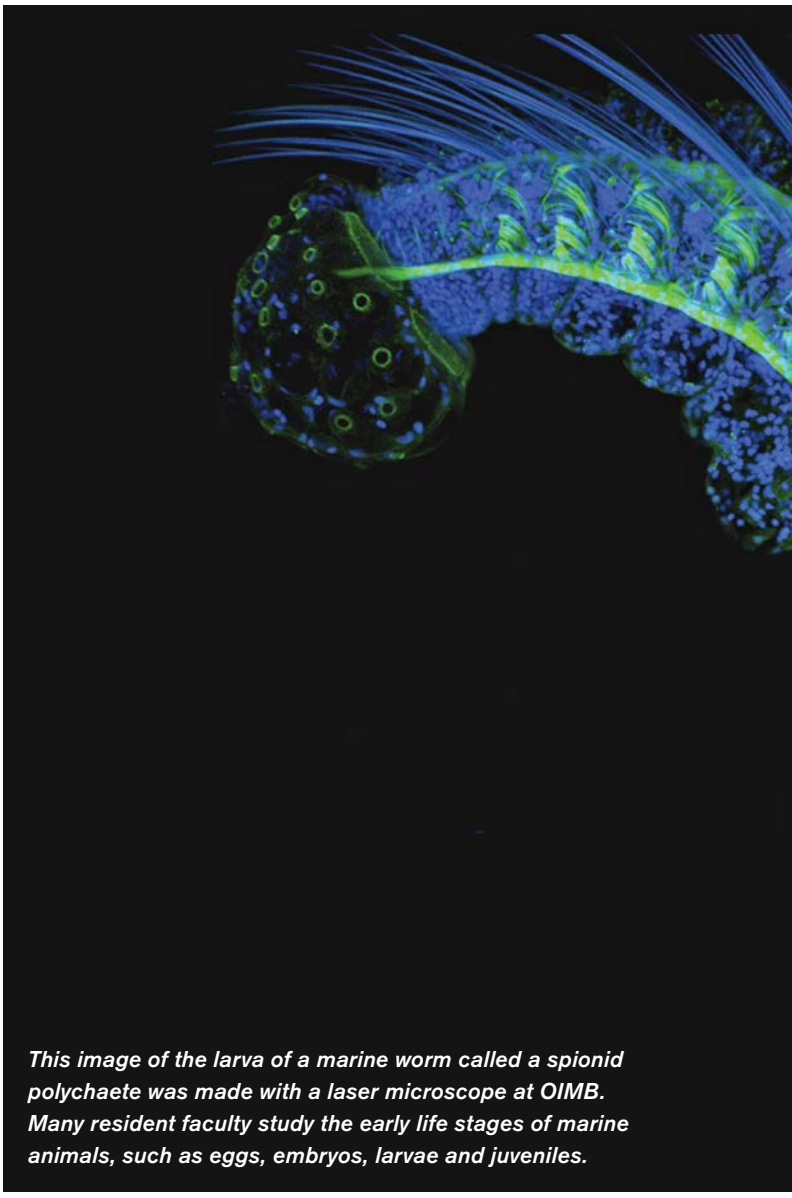
Shanks believes, and his research so far confirms, that these invertebrates actually spawn and produce plankton during winter's heavy

> "THERE'S A PERCEPTION THAT MARINE BIOLOGY IS ALL SWIMMING WITH PORPOISES AND DIVING ON CORAL REEFS IN TROPICAL OCEANS, BUT MOST OF IT INVOLVES REALLY CAREFUL WORK THAT IS TIME-CONSUMING."

storms, when prevailing currents keep the tiny larvae in favored shallow-water habitat. If they spawned in spring or summer, as is more typical for other animals, the upwelling currents would carry the plankton seaward into deeper water, reducing the chance they would survive and grow into adults.

Hansen and several other undergraduates have signed on to the project. They spent last winter working a grueling sampling regimen that had them out on the water every day, seven days a week, taking samples from plankton traps on the ocean and in the bay.

Once they got back to the lab, students then spent hours at microscopes inventorying the tiny plankton to separate out those that Shanks is studying. For a seasoned researcher, it's tedious work.



GREG BOLT

This image of the larva of a marine worm called a spionid polychaete was made with a laser microscope at OIMB. Many resident faculty study the early life stages of marine animals, such as eggs, embryos, larvae and juveniles.

But for an undergraduate just learning the research ropes, it can be a revelation.

"It's truly spectacular," Hansen said. "I would say it's one of the greatest learning experiences I've had [at the university]."

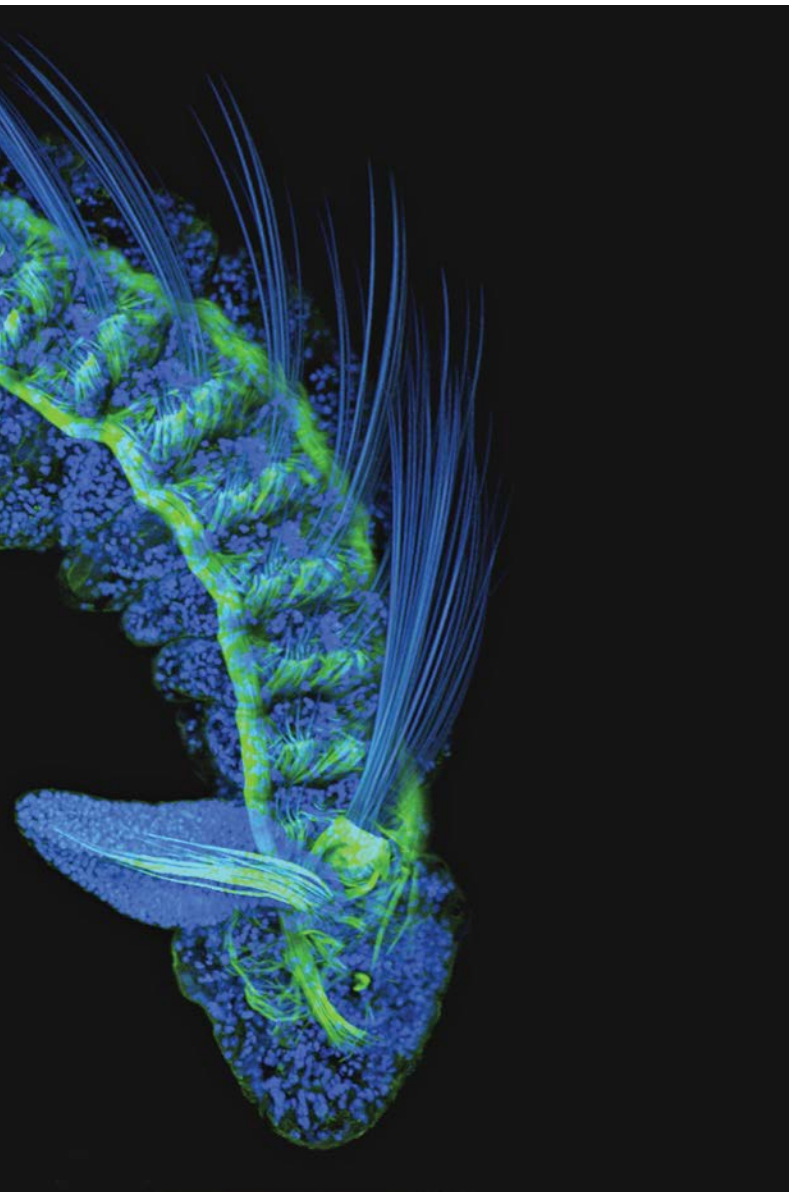
Shanks and fellow marine biology professor Richard Emlet had six undergraduates working for them last winter on the plankton project. It was essential to collect samples daily to accurately track the beginning and end of spawning season and collect the full range of larvae, but that meant having students out collecting samples every single day, in all kinds of weather.

"It was intense," Shanks said. "But these are enthusiastic people. This is what they want to do."

AN OCCUPATIONAL HAZARD

Kara Robbins, a Wyoming native, was a regular on those sampling trips and said they were everything she hoped marine biology would be—with the possible exception of seasickness.

But Robbins brushed that off as an occupational hazard. There were times, she said, when the excitement of the work made her forget she was on a relatively small boat pitching up and down on a very large ocean. For a moment, at least.



SVETLANA MASLAKOVA

"You can forget about it in the excitement of the work, but then you'll look up and suddenly start thinking, 'Not good, not good, not good,'" she said. "But if it's what you love doing, then you kind of take the bad with the good."

That's an attitude that makes undergraduates such an important part of OIMB's research, Young said. Because research, frankly, can be boring. Or at least certain parts of it are, especially if you've been doing it for years or decades.

But for undergraduates getting their first taste of the intellectual smorgasbord research offers, it's all good. The experience gives some of them a leg up on the next stage of their careers, while others decide that it's time to change course and choose another destination.

"I think there's a perception that marine biology is all swimming with porpoises and diving on coral reefs in tropical oceans, but most of it involves really careful work that is time-consuming," Young said. "Here, students learn what research is really like and whether a career in research or academia is what they want to do. Unfortunately, a lot of undergraduates don't get that kind of experience until late in their education, or not at all."

Senior Ashley Hueckstaedt, another Wyoming native, has found research anything but boring. She's working with graduate student

MARINE BIO 101

Did you know? Through the Oregon Institute of Marine Biology, the UO offers the only undergraduate marine biology degree in the state of Oregon.

- OIMB, located near Cape Arago on the southern Oregon coast, includes 23 buildings on 100 acres of land.
- The UO has been conducting research in marine biology since 1924.
- The marine biology major was established in 2004. Since then, more than 75 students have received marine biology degrees.
- In addition to jobs in academia, marine biology graduates go on to become state or federal fisheries biologists, fisheries observers and biologists, environmental specialists, doctors, dentists, veterinarians, aquarists, school teachers and community educators.
- Courses include Estuarine Biology, Biological Oceanography, Marine Environmental Issues, Animal Behavior, Invertebrate Zoology, Subtidal and Deep-Sea Ecology, Marine Birds and Mammals and Biology of Fishes.
- OIMB offers a course that takes students to the Caribbean coast of Panama to study the biology of tropical coastal habitats.
- OIMB's fleet includes flat-bottom aluminum boats for use in the estuaries, an inflatable Zodiac that can be used near shore in the open sea, a 42-foot inboard trawler that can be used up to 20 miles offshore, a 20-foot covered aluminum boat for use in Coos Bay and a large kayak for estuarine work.
- Marine biology majors are required to spend three terms at OIMB, typically in their junior or senior year. They stay in dorms onsite (shown above).

Kirstin Meyer on a project to better understand the extent and diversity of subtidal marine life in the Cape Arago area, which has been suggested as the site of a future marine sanctuary.

Part of the work involves towing a camera sled behind the *Pluteus* and photographing the kelp, sea urchins, crabs and other plants and creatures that make their home there. Later, Hueckstaedt and other students help analyze the pictures to better understand how much and what kind of sea life the area supports.

At times the work is like pulling back the curtain on a view human eyes have never before witnessed.

"It's amazing because I didn't realize how much was down there," Hueckstaedt said. "There's some things down there that have never been seen before. It's incredible."

That's the kind of experience that creates such a strong connection at OIMB. Young said students not only learn more but also remember more because of the way classroom lectures are combined with field experience, something Hansen found to be true.

VOYAGE TO THE BOTTOM OF THE SEA

"The cool thing is, we would be in class learning about something, and then we'd go out and we'd actually see it," he said. "In a lecture, it's just words the teacher is saying. But when you go out there, that's when all the connections are made. That's when learning happens."

And learning sometimes happens in more exotic places as well. Faculty members often have room for undergraduates on research expeditions that can take them to oceans all over the world, and even on voyages to the bottom of the sea.

That's exactly where several undergraduates found themselves this past summer, after Young offered them a chance to take part in a research trip to the Gulf of Mexico. Some even participated in deep-sea dives in the famed submersible *Alvin*, operated by Woods Hole Oceanographic Institution. In fact, the trip was the first science mission for *Alvin* following an extensive rebuild and upgrade and helped mark the sub's 50th anniversary.

SCIENTISTS FROM ALL OVER THE WORLD COME TO OIMB BECAUSE IT IS SURROUNDED BY AN ALMOST UNRIVALED ECOSYSTEM OF MARINE PLANTS AND ANIMALS.

Up until that voyage, Hueckstaedt had known *Alvin* only from the cable television show *Animal Planet*. Although she grew up far inland in Wyoming, Hueckstaedt fell in love with the sea after seeing it for the first time as an eight-year-old on a family trip to California.

After that, she rarely missed a television show or documentary about the ocean. But the idea she might one day be one of those people she had watched climbing into a submarine? Forget it.

"I never in a million years thought I would go down in *Alvin*," she said.

Hueckstaedt was a plankton sorter on the trip. Young studies the reproduction and early life stages of marine invertebrates, and he's particularly interested in animals that live around—and are sustained by—naturally occurring methane seeps found in the Gulf, Caribbean Sea and Atlantic Ocean.

One of the questions Young is trying to answer is how mussels and other invertebrates travel among widely separated seeps and pass their genes to successive generations. The answer may well be found in plankton, the larval stage of the creatures, and that's what brought him and his undergraduates to the Gulf.

UNTOLD TONS OF WATER

Alvin has space for one pilot and just two scientists, so going on a dive can be a rare honor for undergraduate students. Hueckstaedt was in such a state of wonder on her dive that she doesn't remember how long it lasted and didn't care that untold tons of water were pressing hard around her.

Left to right: Senior Ashley Hueckstaedt got to go on an* Alvin *dive in the Gulf of Mexico. She has also logged research time on OIMB's* Pluteus*, dragging a camera sled behind the vessel to photograph kelp, sea urchins, crabs and other plants and creatures. *(Photo: Craig Young)*

Kara Robbins, an undergraduate from Wyoming, says there were times when the excitement of the work made her forget she was on a relatively small boat pitching up and down on a very large ocean. *(Photo: Greg Bolt)*

Anders Hansen, now in his second year as a marine biology student, won a coin toss for a seat on an* Alvin *dive. *(Photo: GB)*

"You don't really notice time, because you spend all of it with your face right up against the porthole," she said. "You don't even think that if you went outside you'd be crushed in an instant."

Hansen also got a berth on that voyage and, after a coin toss went his way, a seat on an *Alvin* dive. His dive took him thousands of feet down to one of the strange underwater brine pockets that form around methane seeps, which also are known as "cold seeps."

As the sub sank into the darkness of the Gulf, Hansen was awestruck by the sheer variety of life in the depths. Strange-looking eels came to investigate the sub, and weird lobsters, shrimp and snails appeared in the sub's powerful spotlights.

At times it felt like a fantasy. But paradoxically, Hansen also felt more connected to the living world than ever before.

"It didn't even really sink in at first that it's reality," he said. "It's difficult to actually describe it. It gave it a different depth of reality."

But if deep in the Gulf of Mexico isn't enough, OIMB undergraduates also have a chance to take part in a research class on tropical biology taught by Richard Emlet and senior lecturer Janet Hodder in Panama, or help Cynthia Trowbridge, a senior research associate, on an annual trip to Ireland.

The Trowbridge project brings a team of undergraduate and graduate students to the Lough Hyne Marine Reserve on the shores of West Cork, Ireland, to investigate a sudden decline in sea urchins and the possible role of an invasive algae species in the drop-off. Students spend about a month living in a cottage on the shore of the marine lake while they help with ongoing research.

But students don't have to go halfway around the world to experience the wonder and diversity of marine life or to find strange or even entirely new species.

Scientists and students from across the country and all over the world come to OIMB because it is surrounded by an almost unrivaled ecosystem of marine plants and animals. The region's headlands, ocean shelves, tide pools, kelp forests and shorelines provide a world-class laboratory for both study and exploration.

"Some of the most spectacular rocky shores in America—actually, in the world—are located right here," Young said. "OIMB is one of the best places in the world to find a high diversity of marine organisms within reach of a marine research center."

NEVER A DULL MOMENT

Yet for all its research advantages, the institute is still a relatively small field station. Students enjoy classes that rarely have more than 20 students and that sometimes have two instructors, so there's plenty of face time with faculty members. It's an immersive learning experience that's rare on larger campuses.

This environment sparks both awe and inspiration. It creates a pull students feel every day, something that draws them to the water's edge even without the excuse of a class assignment or research project.

In large part, that's probably why students here seem to spend far less time staring into smartphones or laptops or televisions than their peers on the UO's main campus. You might think that, even with its small-town charms, Charleston would send young people running for the nearest high-speed cable connection.

But you would be wrong.

"I don't really have any dull moments," Hueckstaedt said. "If I'm not studying or sleeping or eating, I'm probably in the tide pools."

It's the same with most other students at the institute. People here have a shared love of the sea and the shore and the things that live there, but there's a bonding among OIMB students that goes deeper than that.

When you've spent time with the same group of people leaning over the rail on the *Pluteus* on days when the sea isn't the only thing that's heaving, when you've shared long days in the same lab sorting tiny plankton, when you've sat in the same daylong classes and watched out for each other around kelp-slickened tide pools, you come to be more than just classmates.

"It's a great community," said Stumbo, the recent OIMB graduate. "It's a very unique experience, especially at a big research university."

A "Winterover" in Antarctica

STUDYING COLD-WATER FISH TO BOLSTER KNOWLEDGE OF HUMAN BONE LOSS

It's not the sort of thing you'd expect in a marine biology major. But the truth is, Ashley Nelson tends to get seasick.

But, oh, the places where she's been sick.

The recent UO graduate spent summer 2013 at Palmer Station, Antarctica, working as a research assistant for biology professor John Postlethwait. That meant a four-day, 750-mile boat ride from Punta Arenas, Chile, to the tip of the Antarctic peninsula—through some of the roughest seas on the planet. But for Nelson, it was worth it.

First, there was the scenery. The station sits at the foot of the Marr Ice Piedmont, where cliffs of iridescent blue loom behind the cluster of metal-clad buildings, a scene Nelson described in an email to her parents when she arrived in May 2013.

"The first thing I saw was the Marr glacier right behind the station," she said. "I told them that I'd never seen ice that blue, and that it was absolutely beautiful and serene."

At 64 degrees south latitude, Palmer Station (left) actually is above the Antarctic Circle, which means it doesn't get quite as dark for quite as long as bases closer to the South Pole. Winter in Antarctica coincides with summer in the Northern Hemisphere, so Nelson saw her daylight limited to about four hours a day of twilight while her friends here were enjoying the longest days of the year.

But the polar landscape was anything but boring. Even with the short days, Nelson and her crewmates had regular chances to get out and explore, hiking and showshoeing to the top of the nearby glacier or roving about in inflatable Zodiac boats. Penguins and seals were common sights, and once a huge flock of hundreds of cormorants did a 360-degree circle around her and some companions, putting them in the center of a vortex of birds.

"There's no words to describe it, other than it was out of this world," she said.

Then there was the job. Being a research assistant isn't always the most glamorous work, but Nelson would be responsible for key parts of an ongoing project with implications in the treatment of bone diseases such as osteopenia, a predecessor of osteoporosis, and anemia, which is a loss of red blood cells.

And to do that, Nelson would become that most hardy type of Antarctic researcher, the "winterover." A winterover stays at the research station through the long, dark

Recent UO grad Ashley Nelson, with a rockfish, during her sojourn at Palmer Station. Rockfish are used as a comparator or control in the icefish study. They have a standard bone density structure, so UO scientists can compare the DNA of the rockfish to blackfin icefish (left) to help narrow down genetic factors at play in making icefish bones so much lighter.

Antarctic winter, when bases are reduced to skeleton crews after the departure of scientists and support staff members who flock to the polar region during the summer season.

Nelson's job, along with that of a few others, was to collect data and keep the lab running during the slow winter season. Postlethwait and two colleagues at Northeastern University, professor Bill Detrich and postdoctoral fellow Jeffrey Grim, are studying cold-water fish to learn more about how their development and genetics can bolster knowledge of human disease.

In particular, they're looking at the blackfin icefish, an odd, white-blooded species that developed without the swim bladder other fish use to stay buoyant. To compensate, the icefish evolved a fragile but very lightweight bone structure that could aid understanding of human bone development.

Results suggest that icefish end up with such light and fragile bones because genes that cause bones to be more robust in other species don't turn on, Postlethwait said. That could be similar to what happens in elderly people who develop osteoporosis, which is why studying icefish is worth these long treks into the polar wilderness.

"This is likely what happens in some elderly people—they have bone mineralization genes, but these genes stop working as these people get older," Postlethwait said. "If we can find out the molecular nature of the DNA changes in icefish that lead to the failure to regulate bone mineralization genes, we can provide hints as to what might be happening in the elderly that are susceptible to bone loss diseases."

And to learn that, the researchers need to study icefish embryos. Enter Nelson, a budding marine biologist who never thought of herself as much of an adventurer or risk-taker. But that was before her adviser at the Oregon Institute of Marine Biology told her about an opening in Postlethwait's lab. A chance to do science at an Antarctic research station in winter? She jumped, and never looked back.

"I kind of surprised myself by actually going and doing that," she said. "I learned a lot. Not just from the program, but also what I could do myself. I learned that I can do a lot more than I think I can."

A typical day at Palmer started with Nelson "waking the fish," which are caught in the ocean nearby and kept in tanks fed by seawater. The lab varies the lighting in its fish tanks to mimic natural sunlight and encourage breeding. Nelson looked for females that appeared ready to lay eggs, caught them and massaged their bellies to get the eggs. Next, she would find males to get the sperm needed to fertilize the eggs. Last, she put egg and sperm together in an incubator to begin producing embryos for research.

Nelson arrived at the base before the summer crew left, so she learned the routine before being left to handle things along with the other assistants. Even so, the regular contact with professors through the Internet and satellite phones turned out to be vital.

One day, Nelson woke to discover that a pump had failed overnight on one of the lab's five fish tanks. Without the pump, oxygen levels in the water plummeted and nearly all the fish in the tank died. The winter crew contacted Postlethwait and the other scientists and developed a plan to replace them.

That put Nelson back on the water, this time on a fishing vessel stationed at Palmer. She made it through that day without too much queasiness and the lab got its fish and stayed on schedule.

While many schools target graduate students for research jobs, the UO actively recruits undergraduates for these truly cutting-edge opportunities, Postlethwait said. Nelson was one of two undergraduates who spent the winter at Palmer, and she said she feels "honored" to have been entrusted with so much responsibility so early in her career.

Nelson had all the qualities needed for the job, Postlethwait said. In addition to her extensive experience with the UO's marine biology institute, she brought the right attitude to a difficult job.

"Ashley is a quiet but cheerful person, and that's essential for working with the same 20 people you can't get away from in constant darkness and numbing cold," he said. "Also, and more important, she brings a smile to work with her every day."

WHILE MANY SCHOOLS TARGET GRADUATE STUDENTS FOR RESEARCH JOBS, THE UO ACTIVELY RECRUITS UNDERGRADUATES FOR THESE TRULY CUTTING-EDGE OPPORTUNITIES.

The trip was more than physically and mentally demanding; it also forced Nelson to make tough decisions. A student in the Robert D. Clark Honors College, she was on track to graduate in spring 2013, but she chose to delay graduation for a year to take advantage of the opening.

She returned last October—the return voyage to Punta Arenas was much rougher than the trip into Palmer Station, and she spent most of it in her bunk—and finished her honors thesis that fall. She still marvels at the turn her life took when she signed on for the expedition.

"A year and a half ago I would never have believed that I was going to Antarctica," she said. "It was too good of an opportunity to pass up." —GB

FOR RECENT GRADUATE, RESEARCH MISSION ACCOMPLISHED

> "DON'T BE AFRAID TO ALLOW YOUR RESEARCH TO TAKE YOU WHERE IT NEEDS TO TAKE YOU."

In May 2003, President George W. Bush stood at a podium onboard the USS *Abraham Lincoln* and declared an end to major fighting in Iraq under a banner with the now-infamous words: "Mission accomplished."

Less than three years later, the country collapsed in chaos. Civil war erupted in February 2006 and 14,000 Iraqis died in the first six months of that year; indeed, more than 96 percent of casualties suffered by the US-led coalition occurred after Bush's declaration, as a ferocious insurgency fought the occupation.

For Neema Sahebi (above), the evidence is clear: The United States failed to stabilize Iraq due to poor planning and simultaneously alienating the Iraqi people.

FYI: ON THEIR WAY TO EARNING DEGREES, ALL HISTORY MAJORS CONDUCT ORIGINAL RESEARCH. FACULTY MEMBERS GUIDE THEM TO THEIR GOAL, STARTING WITH RESEARCH SEMINARS OF TYPICALLY NO MORE THAN FIFTEEN STUDENTS.

It is not a verdict that he arrived at lightly. Rather, it is the culmination of painstaking research, long weekends spent poring over piles of books and a half-dozen at-times tense interviews with those closest to the truth: US veterans.

Seeking to graduate with honors in history (which he did successfully, last spring), Sahebi originally planned to write a thesis based solely on how U.S. cultural insensitivity contributed to the meltdown in Iraq. But senior instructor Alex Dracobly delivered fateful advice: "Don't be afraid to allow your research to take you where it needs to take you."

For a self-described "war nerd" who regularly engages in Civil War reenactments, it was all Sahebi needed to hear. He planted himself at the UO Knight Library, scrutinizing stacks of texts that included military interviews and memoirs from top brass and former members of the Bush administration; Sahebi estimates that his fifty-plus page assessment of the Iraq War is based on no fewer than twenty-five books, many of which he read cover to cover.

Equally important to Sahebi was the opinion of US veterans—although the notion of interviewing them about failures in Iraq caused him no small amount of nervousness.

Working through Dracobly, Sahebi identified and interviewed five veterans of the war; he met with them individually at restaurants and bars, armed with a recorder, for wide-ranging, open-ended discussions that ran as long as an hour-and-a-half. Some of the veterans spoke with pride about the military's effort in Iraq, others with obscenity-laced frustration. All of them, Sahebi said, warmed up to his willingness to keep an open mind.

"I would ask one question and then just put it aside—I wanted to *talk* to the guy," Sahebi said. "I think they realized I'm looking for facts and my opinion will come at the very end."

The project pushed Sahebi to the brink. Every conversation with Dracobly introduced a new idea to explore or another book to check out. Each full day of classes ended with the daunting proposition of reading up on the Iraq War well into the night. Sahebi learned to pace himself, taking an occasional day off from his research and reminding himself that the work—while demanding—was on a topic that he nevertheless found fascinating.

The result is an unvarnished criticism of the US administration and military, but an unapologetic Sahebi stresses that his report is not an attack on either body. When you look at the "cold, hard facts," he says, it's hard to arrive at any other conclusion.

Friends are reading Sahebi's report and a possible employer—a maker of war-based video games—interviewed him for a position as a consultant. And Sahebi himself has come to appreciate the power of discovery—wherever it takes him.

"I had no idea I was going to be researching the things that I'm talking about right now," he said. "When I think about where this started, I think, 'How the hell did that happen?'" —MC

MATT COOPER

AN EXOTIC RESEARCH TOPIC

Overcoming skepticism to develop an award-winning paper

For Amber Bryan, the most intriguing thing about the world of exotic dancing isn't the sexy performances of women who do it. It's the everyday nature of their lives away from the stage.

"The one girl that I interviewed at her house was dressed in soccer mom clothes, and she was baking—it was a totally different world," said Bryan, who graduated earlier this year. "They do all the stuff that we do: They take out the trash, they mop the floor. They're not sexual beings all the time."

A 2014 graduate in women's and gender studies, Bryan's decision to focus on strippers as the basis for a research project prompted a considerable amount of eye-rolling from some—and a difficult conversation or two with her own mother. But no one can question the results: Bryan's project stood out in a demanding program for promising young researchers and earned her a $1,000 research award from the UO Libraries.

Bryan was a student with the McNair Scholars Program, which prepares qualified juniors and seniors for graduate study leading to PhD degrees. The program provided comprehensive support that enabled her to complete a research project, earn her undergraduate degree and apply to graduate schools; Bryan learned everything from how to write a research paper to what to say in a job interview.

Bryan's interest in the intersection of women's sexuality and exotic dance stems from her days as a waitress in a Houston-based gentleman's club called Baby Dolls. Working with mentor Lamia Karim, associate head of the department of anthropology, Bryan developed a research premise that could be completed within the narrow three-month window required by the McNair program: How does exotic dancing affect women's sexuality?

Working with advance approval from owners and managers, Bryan visited Eugene-area dance clubs; she studied how the dancers interacted with both male and female customers, taking notes by typing into her phone (which made it look like she was texting) to be less conspicuous. She also repeatedly disguised herself—adding glasses or an entirely different style of dress—to remain anonymous to the dancers and preserve the authenticity of the behaviors she witnessed.

Once she had collected enough observations, Bryan introduced herself to individual dancers and explained her project. Twenty-two of them agreed to subsequent interviews. She found that working as an exotic dancer increased women's sexual interest in other women, and also their sexual encounters with both genders. In general, they gained more empathy toward other women, which one dancer summed up best by saying:

> "Since becoming a dancer I have learned that we all have a story that makes us who we are. A person might act a certain way because of what she's been through. This doesn't make her any uglier than anyone else, it makes her unique and it makes her who she is. It makes her an individual. It makes her beautiful in her own way."

Bryan was changed by the experience, as well. Facing regular project deadlines and other academic demands, she developed organizational and critical-thinking skills. She also learned how to talk about her research in a succinct, accessible manner—the so-called "elevator pitch," which serves scholars in presenting their work.

The first member of her family to attend college, Bryan's next stop is graduate school as she pursues a career in nonprofit management or international law.

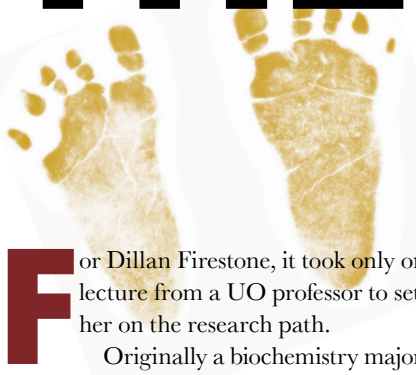
"I learned a lot about myself—I'm so resilient, I have a lot more patience than I thought I did, and I'm capable of doing something huge," Bryan said. "The research experience was a blessing—it taught me to dig deep within myself." —MC

FYI: AMBER BRYAN WAS ONE OF SIX WINNERS OF 2013 LIBRARY UNDERGRADUATE RESEARCH AWARDS, EACH OF WHOM RECEIVED $1,000.

MATT COOPER

THE WORK OF

How premature birth affects



For Dillan Firestone, it took only one lecture from a UO professor to set her on the research path.

Originally a biochemistry major, Firestone (right) was in the College Scholars program when she took part in a freshman colloquium with a guest lecture by human physiology associate professor Andrew Lovering. These one-credit courses introduce students to different facets of academic research, and Lovering's lecture focused on his research on cardiopulmonary respiration.

Fascinated, Firestone approached Lovering and asked if she could come and observe some of his experiments. By the end of her freshman year she had changed her major to human physiology and was working in Lovering's lab—not something every freshman gets the chance to do. Not long after that, she was conducting research for an undergraduate thesis that enabled her to graduate with departmental honors.

Firestone's project looked at the long-term effects on lung function among those born prematurely, particularly the effects on a person's ability to exercise.

Researchers already knew that people born prematurely, defined as those born at least eight weeks early, generally have a lower capacity to exercise. Those later weeks of pregnancy are a vital period for lung development, and being born early can leave children with impaired breathing function.

What isn't well understood is the exact nature of the impairment. Studies had shown that children born prematurely could move gas in and out of their lungs just as efficiently as full-term children, so Firestone looked at the basic ability to take in air, known as the "work of breathing."

Working closely with Lovering's postdoctoral fellow J. J. Duke, she and a fellow undergrad, Carly Celebrezze, recruited two groups of college students, one that had been born prematurely and another that had not. They put them on stationary bikes and, breathing room air, had them exercise to exhaustion.

Then they repeated the experiment, only the subjects were breathing a mixture of helium and oxygen, a gas known as heliox. The difference was striking.

"The preterm subjects could exercise for a longer amount of time while breathing heliox than they could when breathing room air—about 25 percent longer," Firestone said. "That tells us that heliox significantly reduces their air restriction."

The heliox breathing gas seems to make the work of breathing easier for the subjects whose lungs were affected by premature birth, but it had no effect on those who were

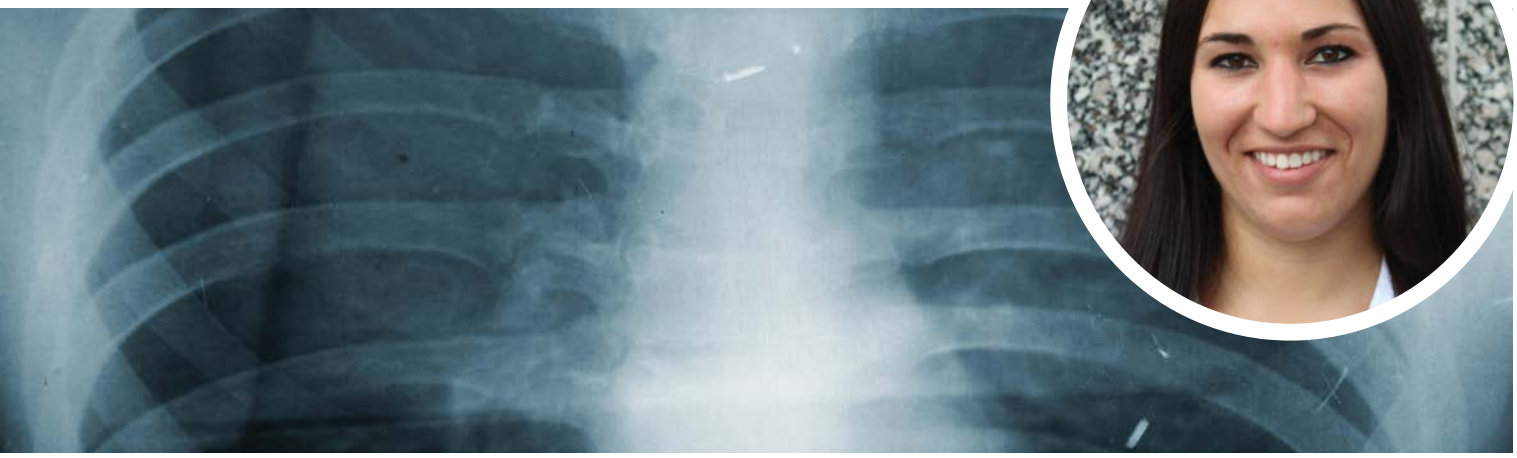
Where Are They Now?

Here's a sampling of jobs landed by recent human physiology graduates:

- **Jenna Bucher** '13, clinical research assistant, Knight Cancer Institute
- **Alex Crane** '13, emergency medical technician, Falck international ambulance services
- **Jennifer Mahan** '13, personal care assistant and physical therapy rehabilitation aide, HIV Alliance
- **Laura Cruz** '12, patient relations representative, Providence Medical Group
- **Sarah Teckman** '12, research assistant, Gatorade Sports Science Institute
- **Matthew Hadeed** '10, pursuing medical degree at Western University of Health Sciences
- **Megan Swift** '10, doctor of physical therapy, Therapeutic Associates Mid-Valley Physical Therapy
- **Anthony Cutting** '09, chiropractor, owner and operator, Active Chiropractic
- **Jesse Liberty** '09, acupuncturist, Well Balanced
- **Torie Barnard** '08, program director, Manna Project International
- **Brent Jones** '08, clinical study manager, Takeda Pharmaceuticals International Company
- **Matt Vu** '08, footwear graphic designer for Jordan brand, Nike

BREATHING

a person's ability to exercise



WITH BOTH CLINICAL AND RESEARCH EXPERIENCE UNDER HER BELT, SHE'S OPTIMISTIC ABOUT REACHING HER CAREER GOAL OF BECOMING A PHYSICIAN'S ASSISTANT.

born at full term. That suggests that one long-term effect of being born prematurely is difficulty taking in air, a finding that formed the core of Firestone's thesis. Other researchers will have to refine the conclusions before a possible therapy can be considered, but Firestone said it's a step forward.

"It lets us understand the implications of being born early and the potential complications that can persist into adulthood," she said.

Lovering said Firestone has been an excellent student who fit in very well with his lab team. Lovering likes bringing younger undergrads into his lab so they can learn from older students and get an early start in tackling actual research.

"All of our research requires a team effort, and Dillan has been an important part of that team," Lovering said. "My approach has worked well for us . . . because I have been fortunate enough to work with students like Dillan."

Firestone has a pretty good idea of where her next stop will be, but it's not the one she was planning when she first arrived on campus. Back then, her goal was a medical degree. But that was before the number of years that would take really sank in.

"I realized that's a lot of school," she said. "I decided I wanted to do something that was almost the same thing, but with less school."

So she's shifted her focus, and now has her sights set on becoming a physician's assistant. But she needs to log some clinical experience before she can start applying, so last fall she started working at a Eugene care center while she finished up her degree in human physiology.

Firestone said she plans to keep the job for another year or two before applying to schools in Northern California or Arizona that are offering a physician's assistant program. And with both clinical and research experience under her belt, she's optimistic about reaching her career goal.

While she doesn't plan to make research her life, she said the experience was invaluable. If nothing else, it gave her a ringside seat to the process that produces all those books she has to read as a student.

"It's allowed me to appreciate how much work and effort goes into the research process," Firestone said. "I guess I didn't realize how much time and energy goes into everything that we're reading." —GB

GREG BOLT

LOOMING DISASTER

Transfer student explores industrial farming and wins thesis award

Shahnaz Mooney (above) has always had a thing for disasters.

When she was a kid, she was fascinated by epidemics. She used to have vivid nightmares about trying to survive a deadly plague. Now that she's older, concerns about climate change are driving her to action.

Small wonder, then, that when Mooney enrolled at the University of Oregon as a sophomore three years ago, she sought out the UO's own "philosopher of disaster": Naomi Zack, who specializes in disaster ethics. It was the beginning of a beautiful relationship.

Under Zack's guidance, Mooney embarked on a sprawling project that earned her a degree from the Robert D. Clark Honors College, majoring in both philosophy and environmental studies; she was also honored at graduation for winning the college's interdisciplinary thesis award.

In her fifty-page thesis, Mooney explores the ethics of feeding antibiotics to animals in industrial farming. Her analysis incorporates philosophy, public policy, science and environmental studies.

Mooney predicts a looming disaster in this practice, noting that "80 percent of (US) meat randomly tested . . . shows traces of antibiotic-resistant bacteria" such as salmonella and E. coli. Despite safe handling practices and cooking techniques, the meat-consuming public remains at risk for dangerous bacterial infections, she writes.

In addition to this public-health concern, she also explores the morality and practicality of antibiotic use in animal feeding and ends with suggestions—domestic and global—for preventing an epidemic.

> HER DREAM JOB WOULD MIX PHILOSOPHY, ENVIRONMENTAL STUDIES AND ART.

Completing a thesis is typically a year-long undertaking and for many students, it would be challenge enough working within one area of study. But Mooney deftly pulled together a project that cuts across multiple disciplines, Zack said.

Mooney's work "combines excellent information about a contemporary problem with analysis of the relevant philosophical and moral systems," Zack said. "It was very enjoyable working with her. She takes suggestions, she's willing to make revisions and she has good critical insights."

The leap of faith with research, Mooney said, is to accept where it leads you; as her investigation shifted in unexpected directions, she reminded herself to remain open to the process. "Being OK with laughing at yourself at times is really important—'OK, I'm still an undergrad,'" Mooney said. "That pressure to finish the project can be stifling and doesn't allow for creativity."

It's a badge of honor for Mooney that her entire education has been in public schools. The knock on public institutions, she said, is that students don't get enough attention; she was surprised by the support she's received at the UO, from graduate students as well as established professors such as Zack.

"I've never felt like a number, even in classes with 150 or 200 students," Mooney said. "It seems like everyone is very interested in student success."

It's also no accident that her final academic effort as an undergraduate cut across so many disciplines.

Mooney is multidimensional herself—her dream job would mix philosophy, environmental studies and art. Accordingly, among her favorite classes at the UO was a course in environmental aesthetics taught by philosophy professor Ted Toadvine and Carla Bengtson, an associate professor in art.

These types of classes force students to think creatively about the issues, Mooney said. Call it training for solving those worrisome problems that kept her awake at night as a child.

"If we're going to solve these big issues," Mooney said, "we need to attack them from different sides." —MC

MATT COOPER

THANK YOU FOR SMOKING

Traveling to Germany to research cross-cultural attitudes

In the United States, smokers are expected to move away from the rest of us. But in Germany, the opposite can be true: If you're not smoking, *you* move away from the smokers.

Jessica Montgomery (right) gleaned this anecdote during a trip to Tübingen, a university town in southern Germany. The recent UO graduate was able to turn her twin loves of psychology and the German language into research on a question that just about everyone has an opinion about: Is smoking immoral?

Montgomery has had a passion for research since setting foot on the UO campus as a freshman.

She was dazzled by a FIG—a freshman interest group, which bridges two subjects—in German studies and psychology, where students explored the power of authority figures. This was perfect for Montgomery, who has Polish Jewish heritage and is fascinated by World War II. When psychology professor Sara Hodges, one of the FIG's instructors, offered Montgomery a job as a research assistant, she jumped.

"The fact that I was invited, as a freshman, to sit in on lab meetings and bring up my ideas for how to frame a study was just insanely cool," Montgomery said. "Once I was exposed to the lab, I thought, 'OK, I found what I want to do with the rest of my life.'"

Committed to taking on her own project, Montgomery joined the honors programs in the psychology and German and Scandinavian departments, both of which require completion of a thesis for the honors distinction at graduation. She was connected to a project in the psychology department under doctoral candidate Brian Clark, exploring how Germans and Americans feel about smoking. To satisfy requirements for the German program, she wrote a second thesis on each country's recent history with smoking as it relates to public policy and cultural attitudes.

> "THE FACT THAT I WAS INVITED, AS A FRESHMAN, TO SIT IN ON LAB MEETINGS WAS JUST INSANELY COOL."

To research her thesis in psychology, Montgomery spent thirteen months abroad—a trip funded by a stipend from the German government—during which she surveyed roughly 150 people, asking them—in German—to rate statements such as "smoking reflects poorly on the person's moral character."

"I stopped people on the street and said, 'Hey, are you willing to answer a question for my thesis?'" Montgomery said. "Almost nobody turned me down. I gave people a piece of German chocolate upon completion."

Once stateside again, Montgomery ran the same survey on campus. She found that American nonsmokers were more likely to condemn smokers and smoking than their German counterparts—fitting, given Americans are generally tougher on smoking. Another find: American smokers seem to share in nonsmokers' general disapproval of smoking.

"Smokers are saying their own behavior is immoral," Montgomery said.

Susan Anderson, a professor in German and Scandinavian, co-led the FIG that Montgomery found so energizing as a freshman. She recalled Montgomery as confident and engaging even then, the first to pop up with an answer and launch a classroom discussion.

Anderson helped Montgomery sharpen the focus of her German thesis, directing her to a number of supporting texts. But Montgomery needed no prodding whatsoever in regularly turning in drafts for editing.

"I've had a number of students who have started a thesis and just can't finish—it's just too much," Anderson said. "But Jessica has this great sense of humor; she's able to laugh when there is all of this pressure coming down on her."

Intent on graduate school, Montgomery already has designs on a project that will again unite psychology and German: how Germans have been perceived since World War II. The research experience solidified her passion for psychology and provided insight into what to look for in a master's program.

"I feel like I have a head start for graduate studies," Montgomery said. "Now that I've conducted research, I know what programs will be a better fit for me." —MC

Doubling Down with a Double Major

The students profiled on these two pages are both "double majors"—i.e., working toward a degree in two fields of study. All told, 1,900 current UO students have declared two or more majors. Some of the combinations are not too surprising—Spanish and ethnic studies, for instance, or medieval studies and history—but consider these very individualized approaches to doubling down:

- **Anthropology and cinema studies**
- **Music and psychology**
- **Chinese and biology**
- **Computer and information science and theater arts**
- **Mathematics and Japanese**
- **Religious studies and environmental studies**

MATT COOPER

ROCKS AND RODENTS

Geological sciences research ranges far beyond the predictable

Yes, geology does rock. Most of the time.

But one can, in fact, be in geology and not study what most of us usually think of as rocks. Some study fossils or soil or the myriad things that happen when rocks get eroded or uplifted or shot out of a volcano.

In other words, geology isn't just rocks. Two University of Oregon undergraduates illustrate the point. One is a hardcore rock guy (who is actually studying lichens), the other mines rock only to get at fossils (which actually are rocks, but most used to be bones).

Both of these students show how far the geological sciences can take you, and how divergent research options are for UO undergrads interested in rocks or the stories they tell. Climb them, study them or sift them, it's another day in the lab for a geologist in training.

LOTS OF LICHENS

Logan Wetherell (below) climbs rocks for fun, but he wants to study them for a living.

Wetherell reached the first step of that goal last spring, when he graduated from the UO with a degree in geology. He hopes to add a master's degree to his credentials before he ascends to a career as a teacher at a community college, with a little research and writing on the side.

It was the climbing that first got him, though. Wetherell took a class on rock climbing at Umpqua Community College, loved it and soon was signed up for geology classes as well.

"When you're climbing, you spend a lot of time staring at rocks close up," he said. "It sucked me right in."

After completing two years at Umpqua, Wetherell transferred to the UO bent on a geology degree. And like many undergraduates, he wanted to bolster his chances for grad school by doing an undergraduate research project.

Of course, the project was focused on rocks. But what Wetherell wanted to know wasn't how they were made but how they are unmade.

You could say that rocks are just soil waiting to happen, and Wetherell aimed to help

LOGAN WETHERELL

scientists better understand how long it takes for that process to begin. That sometimes meant taking to his ropes to measure, of all things, lichen.

There's even a word for it: lichenometry. Lichens often are the first living organisms to colonize freshly exposed rock, and Wetherell wanted to figure out how long it took them to do that, which meant measuring a lot of lichen.

"I never thought I'd be looking at lichen over and over," Wetherell said.

But being an outdoorsy sort of guy, Wetherell liked the fieldwork. He concentrated on a stretch of Highway 101 between

YOU COULD SAY THAT ROCKS ARE JUST SOIL WAITING TO HAPPEN.

Yachats and Sea Lion Caves, using state and county records to find out when roads and rock walls were first built and thus when the rocks were first exposed.

Knowing that allowed him to date the lichens, and measuring them gave him an idea of their growth rate. He measured it at about three-thousandths of a millimeter per year, and estimated that the first lichens would start growing about five years after the rock is first exposed. He then estimated it takes another twenty years before it really kicked off the mineral breakdown that is the first step in soil formation.

Wetherell presented his research findings at the 2014 Undergraduate Symposium, a showcase for undergraduate research.

UO geology professor Josh Roering said Wetherell took on the research with a kind of energy he came to appreciate as one of his student's defining qualities.

"He really attacked lichens," Roering said. "You love to see the light turned on, even if it's shining in some really odd places."

MATT COOPER

IT MAY SOUND SQUIRRELLY

When UO undergraduate Eva Biedron (above) approached paleontology associate professor Samantha Hopkins looking for an idea for a research paper, Hopkins had one word for her:

Squirrels.

Welcome to geology, where conventional rocks aren't always the star of the show. Biedron discovered this when she decided to add a double major in geology with an emphasis on paleontology—a subfield—to go along with her major in biology, where she's focusing on ecology and evolution.

Biedron was a bit of a latecomer to geology. Her original plan was to get a degree in biology and then move on to a medical career, possibly as a doctor. But she changed her mind after a summer study program at a medical clinic in Panama.

"That's when I realized that perhaps the medical profession wasn't for me," Biedron said with a smile.

But she had always been interested in evolution, and after talking with others about how to pursue that interest, she ended up in Hopkins' office. The result was a new interest in research, and she started volunteering in Hopkins' lab, doing small but necessary chores like carefully extracting very tiny fossilized bones hidden in chunks of coarse sediments.

"I really, really liked it there," Biedron said. "The lab atmosphere really caught me. I felt like I fit right in."

It wasn't much later that she had her fateful talk with Hopkins, which set her on an unexpected research course involving our furry friends with a penchant for hiding acorns. Hopkins wanted Biedron to reconcile two different family trees for squirrels, one based on their genetics and the other on the way they looked, also known as morphology.

The idea was to blend the two and come up with a clearer picture of how squirrels developed. The project has given Biedron a chance to dive into both the library and the physical world of squirrel bones, where she hopes to do some computer modeling to help understand how different species of squirrels are related and how they evolved.

It's a complex problem, but that only makes it all the more attractive to Biedron. To her, science is a puzzle she just can't resist.

"It's a problem that needs to be solved, and I want to figure it out," she said. "It gives me even more of a reason to go to class. It's a chance to show that, yes, I've learned something and I can put it to use."

A student in the Robert D. Clark Honors College, Biedron has been interested in science ever since taking a seventh-grade biology class. She's taking on the paleontology research for her honors thesis project.

In addition to her double major at the UO, Biedron also is involved in the Science Literacy Program, helping teach science to nonscience majors. She doesn't even pause when asked if she plans to go on to graduate school—it's a doctoral degree or bust. She hopes one day her own research might kindle in other students the same love of research she found at the UO.

"If I can just spark a little bit of that love of discovery in them, wow, that would be inspiring," Biedron said. —GB

Digging Into Their Careers

These recent geological sciences graduates have unearthed exciting careers:

- **Mike Jeletic '14,** hydrologic technician, US Geological Survey
- **Brendan Buskirk '13,** field hydrologist, US Geological Survey
- **Ned Molder '13,** technician, GroundMetrics, which performs electromagnetic surveys for oil, gas, mining and geothermal exploration
- **Lisa Netzel '13,** field engineer, Schlumberger, a major oil field service company with deep-water rigs in the Gulf of Mexico
- **Varina Smith Zinno '13,** exploration geologist, Alaska Earth Sciences

A UNIVERSE OF POSSIBILITIES

Two physics students take completely different paths in pursuing a passion for astronomy

Astronomers really do have their heads in the stars and their feet on the ground.

For proof, look no further than two astronomy students in the UO physics department. One wants nothing more than to stay on the ground and run the telescopes that probe the heavens. The other is intent on gazing at the sky to unmask a galaxy's hidden secret.

Yet both have found what they're looking for in a program that gives students the opportunity to explore a universe of possibilities, whether they're found on Earth or beyond the atmosphere.

SETTING HER SIGHTS ON THE STARS

Sixteen million light years away, in the heart of a small but bright galaxy, lies a mystery. And a team of UO undergraduates is close to solving it.

Something near the center of M94, a galaxy found in the northern sky just below the Big Dipper, is blasting out X-rays. And for more than a year, team leader Annika Gustafsson (left), a senior majoring in physics and mathematics, has been chipping away at data collected by a telescope in Hawaii (below). By the time she graduates this spring, she'll likely know what that something is.

A leading theory right now is that it's a supermassive black hole orbiting the even larger black hole that is known to exist at the center of the galaxy. If so, it would be the nearest example of a paired system of such star-eating behemoths ever observed.

Whatever it is, Gustafsson will end up as the coauthor of a research paper describing the object that will be published in a peer-reviewed astronomy journal, probably next year—not to mention also having what could be the only UO undergraduate honors thesis ever written from direct astronomical observations and launching herself toward her goal of a doctorate in astrophysics.

SHE WAS ALSO A WALK-ON WITH THE UO'S DIVISION I ACROBATICS AND TUMBLING TEAM.

"It's really exciting," said the Santa Cruz, Calif., native.

A little more than a year ago Gustafsson connected with Scott Fisher, physics lecturer and physics undergraduate studies director. Gustafsson learned Fisher had access to a trove of raw data on the furtive X-ray source in M94, although even then she had no ex-

GEMINI PHOTO: COURTESY OF GEMINI OBSERVATORY

Gemini North (Frederick C. Gillett Gemini Telescope)

Location: Mauna Kea, Hawaii

Owned by: The United States, Canada, Chile, Australia, Brazil and Argentina

In operation: Since 1999

Elevation: 13,600 feet

Number of telescopes: One (318-inch mirror)

Number of students who work there: Three to five interns work at the facility during the summer months, including undergraduates.

Did you know…? Gemini North and Gemini South—its sister observatory in Chile—can collectively access the entire sky for scientists from the six partner nations.

pectation that she would help make a striking astronomical discovery. But she knew she wanted to do research, and she had her sights set on the stars.

If there's one thing Gustafsson is not, it's one-dimensional. In addition to her physics and math majors, she's minoring in business administration. And she was a walk-on with the UO's Division I acrobatics and tumbling team, ending up as a member of the 2012–13 national champion squad.

Gustafsson always has been excited by science and math. It was only after she got to the UO and spent some time helping a graduate student researching women in science that she realized there were stereotypes that often work against women such as her.

"I was never turned off by science," she said. "I just enjoyed it. Nobody told me I couldn't."

And what Gustafsson is doing now is real science. She's been taking the raw observational data and using specialized computer programs to get rid of errors that are inherent in all data taken by telescopes. She is working to remove these artifacts and to really understand the data at a fundamental level. The end product will be clean data that stands up to the scrutiny of peer review and, hopefully, solves the mystery of M94's cryptic fountain of X-rays.

"One of the main reasons I came to the University of Oregon is because it's a real research university," she said. "I don't have any regrets. Things just seem to have fallen nicely into place."

TELESCOPE JOCKEY

Jeremy Bullis loves astronomy. Forgive him, though, if he just doesn't want to be an astronomer.

Bullis (right), a senior, is captivated by telescopes. He loves the cameras and filters and spectroscopes and other gear that capture and coddle starlight. And when the observatory dome slides open to reveal a velvet sky studded with stars, something catches in his throat.

But for Bullis, the idea of sitting at a computer to slice and dice data kind of sucks all the inspiration out of astronomy. He decided he'd rather be the guy running and fixing the telescope than the person looking through it.

No problem.

Bullis found exactly what he was looking for in the UO physics department, where he's become the student leader of a project to build a robotic telescope at the university's Pine Mountain Observatory (far right) east of Bend. Think of it as a senior research project, only more hands-on.

BULLIS WAS THE FIRST UO STUDENT EVER TO BE PICKED FOR A PAID INTERNSHIP AT THE GEMINI OBSERVATORY ON HAWAII'S MAUNA KEA.

Pine Mountain Observatory

Location: Pine Mountain, Oregon

Owned by: The University of Oregon

In operation: Since 1967

Elevation: 6,300 feet

Number of telescopes: Four (14-, 15-, 24- and 32-inch mirrors)

Number of students who work there: Three undergraduate physics majors

Did you know . . . ? PMO is one of the few professional observatories open to the public at night and it houses two of the largest telescopes in the Pacific Northwest.

A double major in physics and math, Bullis has the academic chops to be an astronomer. He worked alongside fellow physics-math major Annika Gustafsson (left) on her project analyzing an unknown X-ray source in the galaxy M94, and last summer he was the first UO student ever to be picked for a paid internship at the Gemini Observatory on Hawaii's Mauna Kea.

That experience sealed his preference for the support work of astronomy over actual research. He remembers making it up to the 13,600-foot-high observatory, huffing and puffing up five flights of stairs in the thin mountain air to the telescope deck and being simply blown away.

"I think that's when I really got hooked," he said of his first sight of the 75-foot tall telescope and its array of cameras and technical gear. "It was at Gemini that I realized that I'm more interested in enabling the research than being the person behind the computer analyzing the data."

Fisher, the undergraduate studies director in physics, said Bullis was an obvious choice for the Pine Mountain project. Funded by donor Ken Robbins, a longtime supporter of the observatory, the new 14-inch telescope will be entirely remotely operated from an office in Willamette Hall. Robbins was honored at a ceremonial ribbon-cutting at the observatory earlier this year.

A lifelong tinkerer and son of an engineer, the 28-year-old Bullis used to go to Goodwill stores with his brother just to buy things to take apart. But engineering wasn't in his blood; the stars were.

"That's pretty much what brought me here in the first place," he said. "It was astronomy and my love of the stars that brought me to this program."

The Pine Mountain project is a technological challenge, if only because of all the instruments connected to the telescope. Bullis spent all of last summer at Pine Mountain as a research assistant, and is now back on campus for his senior year.

And now he becomes a telescope jockey.

"Jeremy's job is going to transition from apprentice mountain guy to master telescope operator," Fisher said. "He's going to be the guy that knows the system inside and out." —GB

PMO PHOTO: BEN CANALES

UNDERGRADUATE SYMPOSIUM

It's one thing to commit the countless hours of work necessary to complete a research project. It's quite another to present that work to the world.

Mathew Beattie experienced this firsthand at the 2014 Undergraduate Symposium, a research showcase for undergraduates at the University of Oregon. Majoring in both biology and geology, the junior came to the symposium last May to share his research on how diet affects development in mammals, eager to engage in conversation about his work. A parade of visitors who stopped by to view his poster at the event was more than happy to oblige:

"Why did you do it this way?"

"What if you'd done this test?"

"Did you consider looking at this?"

Beattie didn't shy away from this critical analysis of his project. In fact, he welcomed it.

"The symposium provides a platform to get your ideas out into the community," he said. "I've never been the kind of person who needs to be right. I want the right answer; if you have the ability to help me find the answer, then I'm all about a critique. I'm never going to dissuade discussion."

A multidimensional conversation about research: That's one way to look at the annual symposium, a daylong event during which young scholars interact with peers and faculty members and practice presenting their work to a group that could one day be pivotal for their success—the general public.

More than 100 students participated in the fourth annual campuswide event, which features work in the natural and social sciences, humanities, the arts, design, architecture and business. Consistent with the university's status as a leading public-research institution, the symposium provides a training ground for students as they start developing the presentation skills they'll need to be successful in careers, said Kevin Hatfield, an event organizer and assistant director of residence life.

"If part of what we're doing is walking students through the scholarly process, this is helping students take the next step: 'What do I do after the research is complete?'" Hatfield said. "For some students, it's the first time they've presented their research in public. They're learning transferable skills—how to talk to a lay audience—that propel them to graduate school and professional careers."

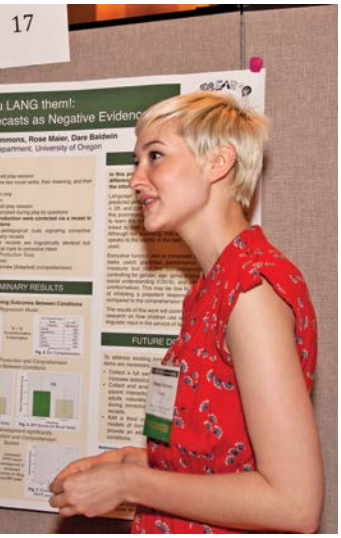
Symposium entries must represent "original undergraduate research," Hatfield said—the creation of new knowledge. But there are multiple ways to meet the requirement. Students can submit their work toward a senior thesis, contribute to a laboratory project, complete an extensive, termlong assignment or even create an artistic effort, which falls in the symposium's creative-performing arts category.

All submissions must be approved by a faculty mentor. A faculty panel then reviews each submission, working with the applicant to sharpen the style and clarity of the project over a period of weeks; this is a "blind review process," Hatfield noted, in which the panel does not know the applicant's identity.

Those accepted to the symposium choose from two formats for presenting their work: poster-sized displays of their research or oral panel discussions, during which students give brief, formal lectures to an audience and then answer questions.

There's more to research than sequestering yourself in a lab or toiling endlessly over spreadsheets, Hatfield said—scientists and scholars must be able to explain their work in ways that inform and inspire a variety of audiences, from peers, academics and employers to prospective donors and the general public.

Poster presenters learn to summarize and illustrate complex ideas, using images and other visual aids to design compelling, easy-to-follow displays. In the spontaneous interaction with those stopping by to view their posters, they learn to translate complicated concepts into conversational language. The oral panelists, meanwhile, practice responding to technical questions like those they'll be receiving at academic conferences and in informal and formal settings at the graduate and doctoral level.



Left to right: Logan Wetherell, geological sciences (photo: Mandi Garcia); Kendra Walters, geological sciences; Amanda Hammons, psychology and German; Mathew Beattie, biology; Marina Gross, psychology (photos: Matt Cooper)

Both formats "help you become a better researcher," Hatfield said. He recalled the words of Daniel Wildcat, a professor at Haskell Indian Nations University, who was a keynote speaker at the 2012 event: "You need to be able to explain your research in a way that your grandmother can understand what you're working on."

The university supports symposium participants in multiple ways. Faculty mentors help applicants with the research itself, including how to frame and pursue key questions; the symposium also provides workshops on how to design a poster, write a research abstract and speak to a crowd. All student expenses are covered, including poster materials and handouts.

> "YOU NEED TO BE ABLE TO EXPLAIN YOUR RESEARCH IN A WAY THAT YOUR GRANDMOTHER CAN UNDERSTAND WHAT YOU'RE WORKING ON."

Lisa Freinkel, vice provost for undergraduate studies, said the UO is committed to fostering the process of discovery for students and the breakthroughs that undergraduates make in scholarship, creativity and innovation.

The breakthrough for Amanda Hammons came during her poster presentation at the symposium.

Hammons, who received her degree in psychology and German just a few weeks after the symposium, has been accepted to a master's program in Ontario, Canada. She chose the poster-presentation method to share her work on children's speech errors because she wanted to start thinking about her work in a new way—that is, how to translate reams of information into a few eye-catching illustrations and charts.

With visitors stopping by her poster every few minutes, Hammons also got practice—again and again—in boiling her research down to the essentials.

"That was really great—not everyone that stops by wants to hear this twenty-minute talk about what you did," she said. "It forced me to come up with an 'elevator speech,' which made me think critically about the most important parts of my project."

Junior Marina Gross, on the other hand, wanted to go deep with her research: She chose the oral panel so she could make a more expansive case for her work in accessing long-term memory.

Gross plans to become a professor of cognitive psychology. At the symposium, she said, she practiced how to make her work accessible to a diverse audience that included experienced researchers, faculty members from various departments and students in other majors. She also brushed up on her public-speaking skills.

"The symposium gave me a chance to calm my nerves during a presentation," she said. "It can be a nerve-racking experience, but with practice, my voice gets calmer and I get to enjoy myself more and more while standing in front of a larger crowd." —MC

Fun Facts:

Number of undergraduate participants: 128

Number of posters: 44

Number of oral panels: 43

Number of creative work installations: 2

Number of academic departments represented: 21

Top five CAS departments represented:

Anthropology

Biology

Environmental studies

International studies

Psychology

Longest title for a research entry:
"Traditional Iron Forging in Contemporary Times: An Ethnoarchaeological Study on the Position of Blacksmiths in the Archaeological and Socio-cultural Records," by Sarah Wyer, anthropology

Shortest title:
"Personality Impressions on Twitter," by Tad Falk, psychology

WHAT'S ONLINE

In these magazine pages, you'll read about UO student research projects on topics ranging from biology to *BioShock* to the beautiful game of soccer. But there are far more student research stories than can fit into a single issue of *Cascade*. We're featuring several more online at **cascade.uoregon.edu**. Check out the Online Extras section for these stories:

Gabriel Sanchez, a recent graduate in anthropology, completed his McNair Scholars research project (see facing page) on whaling by indigenous peoples in the Pacific Northwest. He traveled to Washington, D.C., to study the Smithsonian Institution's collection of harpoon fragments, and then the Smithsonian shipped artifacts to him in Oregon for more analysis. Last fall, he presented his work at the Society for Advancement of Chicanos and Native Americans in Science conference.

Haley Gillham, now a graduate student in the UO Department of Human Physiology, received national recognition while working on her undergraduate degree here: the David S. Bruce Excellence in Undergraduate Research Award for a paper she presented at the 2013 Experimental Biology Meeting. She was also one of only 24 students nationwide to receive an American Physiological Society Undergraduate Summer Research Fellowship.

Christine Liu, a double major in psychology and biology, has been awarded a $4,500 grant and an internship through the Howard Hughes Medical Institute Exceptional Research Opportunities Program to pursue

her research into neuroscience. She is also one of three UO students to receive this year's Science, Mathematics And Research for Transformation (SMART) Scholarship for Service (see facing page for details on student funding through the SMART program.)

CASCADE

***Cascade* is the alumni magazine for the UO College of Arts and Sciences**

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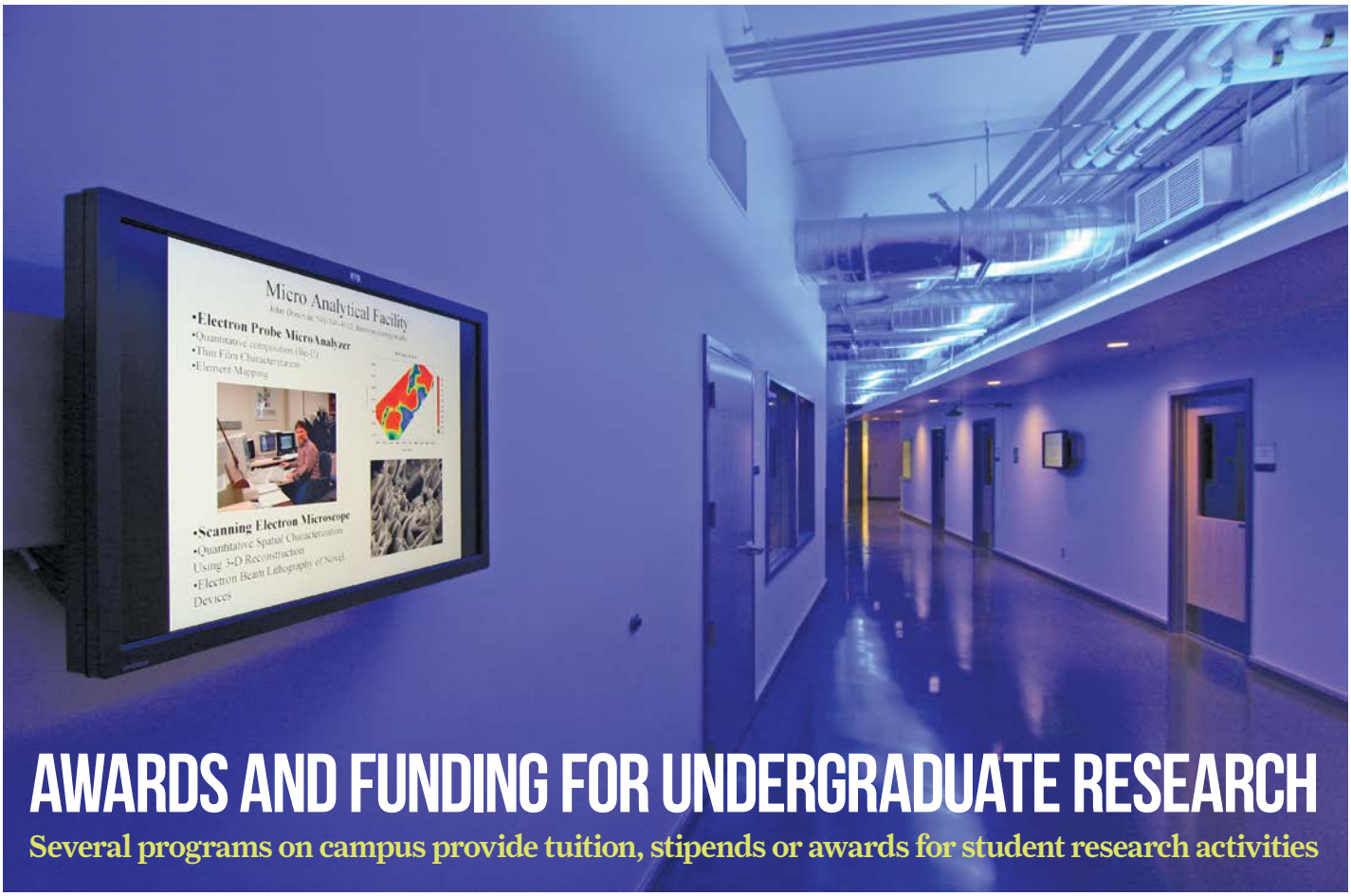
INTERESTED IN RESEARCH?

If you're an undergraduate interested in pursuing a research project—in the lab, in the library or in the field—contact ugresearch@uoregon.edu to get connected with faculty mentors.



AWARDS AND FUNDING FOR UNDERGRADUATE RESEARCH

Several programs on campus provide tuition, stipends or awards for student research activities

The **UO Libraries' Undergraduate Research Awards** recognize students who demonstrate extraordinary skill and creativity in the application of library and information resources to research and scholarship. The awards are granted each spring, with winners typically receiving **$1,000 to $1,500 cash awards**. (See page 17 for a story about a women's and gender studies student who won an award this year for her thesis on exotic dancing.)

Students in the STEM fields—science, technology, engineering and mathematics—can receive a full scholarship as well as employment upon degree completion at a U.S. Department of Defense research facility, under the **Science, Mathematics And Research for Transformation (SMART) Scholarship for Service Program**. Scholarships include a **cash stipend of up to $38,000 a year**, full tuition, required fees, health insurance contribution and book allowance.

The **UO Center on Teaching and Learning** grants three **Undergraduate Research Fellowships** per year, providing a **full-tuition waiver** to promising scholars. Many of the recipients have been science majors, but recent recipients have also included an English major and an anthropology major.

For low-income and first-generation students, or those from a group that is underrepresented in graduate education, the **McNair Scholars Program** is designed to propel motivated students toward earning doctoral-level degrees. The program's many support services include **tuition support plus a $2,800 summer research stipend.**

The **UO R25 Summer Research Program** offers fellowship opportunities for undergraduates to participate in research projects funded by the National Institute of Child Health and Human Development. Participating UO labs include those in molecular biology, neuroscience, psychology and linguistics as well as several others. The program offers **professional training and approximately $3,800 in summer stipends**.

The **Center for Sustainable Materials Chemistry Summer Research Program** provides **$4,000 in funding** for undergraduates to participate in a nine-week summer program during which they are introduced to research techniques and trained in the use of the cutting-edge instrumentation in the underground Lorry I. Lokey Laboratories (above). Student research positions are available in chemistry, physics and engineering.

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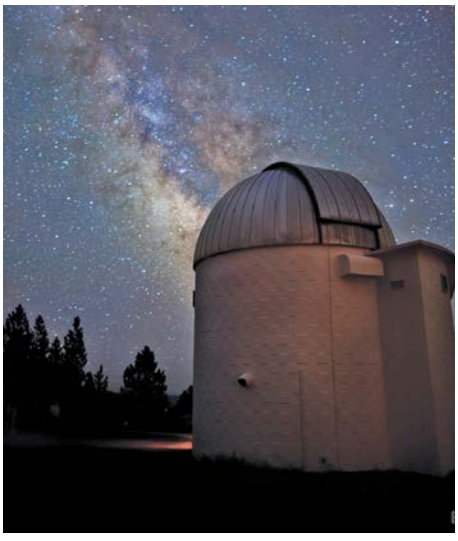

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